DOCUMENT RESUME

ED 448 690 IR 020 453

AUTHOR	Wujcik, Anne
TITLE	Technology in Education, 2000: A Comprehensive Report on the State of Technology in the K-12 Market.
INSTITUTION	Market Data Retrieval, Inc., Shelton, CT.
ISBN	ISBN-1-57953-214-4
ISSN	ISSN-1096-7222
PUB DATE	2000-00-00
NOTE	166p.
AVAILABLE FROM	Market Data Retrieval, 1 Forest Parkway, P.O. Box 907, Shelton, CT 06484-0947 ($195). Tel: 800-333-8802 (Toll Free); e-mail: mdrinfo@dnb.com; Web site: http://www.schooldata.com.
PUB TYPE	Reports - Research (143)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Computer Uses in Education; *Educational Technology; Elementary Secondary Education; Equal Education; Internet; Multimedia Materials; Optical Data Disks; Public Schools; *School Surveys; Tables (Data)
IDENTIFIERS	*Access to Computers; Technology Integration

ABSTRACT

This report presents the results of Market Data Retrieval's (MDR's) annual survey (conducted during the 1999-2000 school year) of the technology market in public education. Each year the MDR survey asks schools to respond to essentially the same questions about their access to and use of computers, CD-ROMs, networks, Internet, and other technologies. This report further explores the story of the "digital divide" that was documented in the 1999 report. Approximately 34% or 30,200 of the 87,700 public schools in the United States contacted responded. The chapters in this report examine the current usage levels of a variety of technology products. Each is examined in terms of a range of school demographic characteristics, such as enrollment, grade level, and poverty level. In general, the higher the grade level and the larger the school, the likelier that school is to own a given technology. But as penetration for technologies such as CD-ROM, multimedia, and networking approaches saturation, the effect of even grade level and size is dampened. Elementary schools are rapidly closing the gap that used to separate them from high schools. Small schools are nearly as likely to use selected technologies as are large schools. Chapters include: Computers for Instructional Use; Networking; Internet Access; CD-ROM use; Videodisc Player Use; Teacher Skill Level and Professional Development; and Technology Expenditures. An additional chapter introduces MDR's new Tech Sophistication Index, an indicator that provides a measure of how schools rank in terms of their overall technology profile. Seventy-five figures and sixty-eight tables illustrate findings throughout the report. (AEF)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 448 690

Technology in Education 2000

IR020453

PERMISSION TO REPRODUCE AND
DISSEMINATE THIS MATERIAL IN
MICROFICHE ONLY HAS BEEN GRANTED BY

M. Hance

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)

2B

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

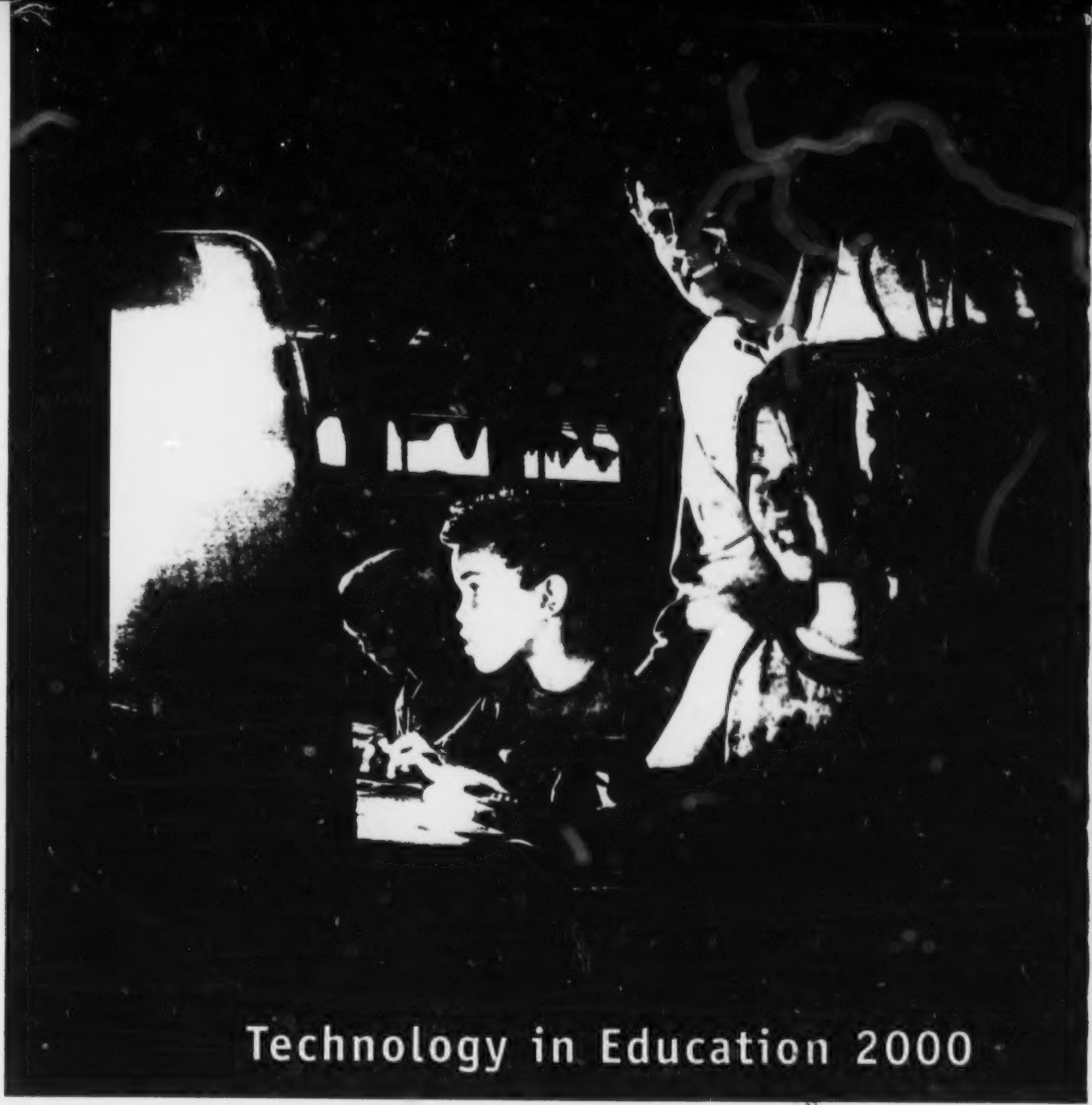
☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Market Data Retrieval
[illegible]

BEST COPY AVAILABLE



Technology in Education 2000

A Comprehensive Report on the State of Technology in the K-12 Market

Market Data Retrieval
A company of The Dun & Bradstreet Corporation

Copyright 2000 by:

Market Data Retrieval
1 Forest Parkway
P.O. Box 907
Shelton, CT 06484-0947

www.schooldata.com

BEST COPY AVAILABLE

Published by Market Data Retrieval
1 Forest Parkway
P.O. Box 907
Shelton, CT 06484-0947

Copyright 2000 Market Data Retrieval, a division of Dun & Bradstreet, Inc.

Copyright 2000 Market Data Retrieval, a division of Dun & Bradstreet, Inc. All rights reserved. No part of this report may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, except as may be expressly permitted by the 1976 COPYRIGHT ACT, or in writing by Market Data Retrieval, 1 Forest Parkway, P.O. Box 907, Shelton, CT 06484-0947.

Market Data Retrieval and its agents have exercised reasonable efforts in gathering and preparing data and information published in *Technology in Education 2000*. Market Data Retrieval does not assume and hereby disclaims any liability for any loss or damage caused by errors or omissions resulting from negligence, accident, or other causes.

ISBN 1-57953-214-4

ISSN 1096-7222

Copy Number: ________________

Table of Contents

Introduction 1

Executive Summary 3

- Technology Overviews 9
- Summary Results 14
- Definition of Terms 17

Computers for Instructional Use 19

- Installed Base – Quantity Projections 20
- Computer Intensity 21
  - School Type 25
  - Minority Enrollment 26
  - Student Need Indicator 27
- Computer-Intensive Schools 28
  - School Type 31
  - School Type vs. School Enrollment 31
  - Minority Enrollment 32
- Installed Base – Brand Shares 32
- Predominant Computer Brand 33
- Processor Type 35
- Poverty Level 36
- Locations Within the School 40
  - School Type 42
- Computers Available After School Hours 43
  - School Type 44
- Windows Users – User Profile 44
  - State Penetration Levels 44
  - School Type vs. School Enrollment 47
  - School Metro Class 47
  - PCs by Windows Version 48
- Multimedia Computers 48
  - State Penetration Levels 48

- Multimedia Computer Intensity 51
  - Minority Enrollment 55
  - Student Need Indicator 56
  - Classrooms With Multimedia Computers 57
- Multimedia Computer-Intensive Schools 57
  - School Type vs. School Enrollment 60
  - Minority Enrollment 60

Networking **61**

- Local Area Network (LAN) - User Profile 62
  - National and State Penetration Levels 62
  - School Type vs. School Enrollment 65
  - Poverty Level 66
  - Computer Intensity 67
  - Networked Computer Intensity 67
  - Networked Computer Intensity by Poverty Level 71
  - Networked Computer Intensity by Minority Enrollment 72
  - Quantity of Computers on LANs 73
  - Classrooms With Networks 73
  - Types of Network Systems Used 74
- Wide Area Networks 74
  - National and State Penetration Levels 74
  - School Type vs. School Enrollment 78
  - Metro Class 79
  - Percentage of Classrooms Networked 79
  - Computer Intensity 80
  - Metro Class by Poverty Level 80

Internet Access 81
  Internet Access – User Profile 83
    National Penetration and Enrollment 83
  Poverty Level 87
    Student Need Indicator 88
    Computer Intensity 89
    Internet Computer Intensity 90
    Internet Computer Intensity by Poverty Level 93
    Internet Computer Intensity by Minority Enrollment 94
    Internet Computer Intensity by Student Need Indicator 95
    Internet Connection Type 96
    Locations of Internet Access 98
    Classrooms With Internet Access 100
  Internet Use for Instructional Purposes 101
    Schools Subscribing to Online Curriculum Content 105
    E-Mail Accounts 108
CD-ROM Use 111
  CD-ROM – User Profile 112
    CD-ROM Intensity 112
    Minority Enrollment 116
    Platforms/CD-ROM Towers 116
    Locations Within Buildings 117
    DVD Drives 118
Videodisc Player Use 119
  Videodisc – User Profile 119
    National and State Penetration Levels 120
    School Type vs. School Enrollment 123
    Poverty Level 123
    Media Retrieval Systems 124
    School Type vs. School Enrollment 124

Teacher Skill Level and Professional Development 127
- Daily Use of Computers 128
- Technology-Use Skill Level 131
- Hours of Technology-Related Professional Development 133
- Training-Intensive Schools by School Type and Enrollment 133
- Training-Intensive Schools by Poverty Level 134

Technology Expenditures 135
- Technology Spending 135
- Expectations for Technology Spending 136
- Technology Spending by Category 137

Technology Sophistication Index™ (TSI) 139
- TSI Overview 140
- Demographic Characteristics 140
  - Enrollment 140
  - School Type 140
  - Metro Class 142
  - Poverty and Minority Demographics 143
- Technology Penetration 145
- Computers and CD-ROM 147
  - Computer Intensity 147
  - Processor Type 148
  - CD-ROM Intensity 148
- Internet Access 149
  - Internet Connection Type 149
  - Locations of Internet Access 149
  - Internet Use for Instructional Purposes 150

Methodology 151
- Sample and Data Gathering 151
- Survey Respondents 151

About Market Data Retrieval 152

About the Author 152

List of Figures

Figure 1 Computer Intensity Levels 1995-2000 5
Figure 2 Computer Intensities 1999-2000 6
Figure 3 Teachers: Use of Selected Technologies 1999-2000 7
Figure 4 Technology Overview by School-Level Penetration 9
Figure 5 Technology Overview: Schools by Enrollment 10
Figure 6 Technology Overview by School Type 11
Figure 7 Technology Overview: Schools by Metro Class 12
Figure 8 Technology Overview: Schools by Poverty Level 13
Figure 9 Computer Intensity by School Type 14
Figure 10 Computer Inventory 1995-2000 21
Figure 11 Computer Intensity 1995-2000 22
Figure 12 Computer Intensity 24
Figure 13 Computer Intensity by School Type 1999-2000 25
Figure 14 Computer Intensity by Minority Enrollment 1999-2000 26
Figure 15 Computer Intensity by Student Need Indicator 1999-2000 27
Figure 16 Computer-Intensive Schools 30
Figure 17 Computer Brand Share 32
Figure 18 Predominant Computer Brand 1999-2000 34
Figure 19 PCs by Processor Type 35
Figure 20 Macintosh Computers by Processor Type 37
Figure 21 Schools With Power Mac Computers 39
Figure 22 Classrooms With Computers by School Type 1999-2000 41
Figure 23 Computers by Location 42
Figure 24 Computer Access for After-School Use 1999-2000 43
Figure 25 Schools Using Windows 46
Figure 26 Computers Using Windows by Version 48
Figure 27 Multimedia Computers: Percentage of Installed Base 50
Figure 28 Multimedia Computer Intensity 53
Figure 29 Multimedia Computer Intensity by School Type 1999-2000 54
Figure 30 Multimedia Computer Intensity by Minority Enrollment 55
Figure 31 Multimedia Computer Intensity by Student Need Indicator 56
Figure 32 Multimedia-Intensive Schools 59
Figure 33 Schools With LANs 64
Figure 34 LAN Penetration by School Enrollment 1998-2000 65
Figure 35 Networked Computer Intensity 69
Figure 36 Network Computer Intensity by School Type 70

Figure 37 Networked Computer Intensity by Poverty Level 71
Figure 38 Networked Computer Intensity by Minority Enrollment 72
Figure 39 WAN Penetration by School Enrollment 1998-2000 75
Figure 40 Schools With WANs 77
Figure 41 Internet Penetration by School Enrollment 1998-2000 84
Figure 42 Schools With Internet Access 86
Figure 43 Internet Access by Poverty Level 1998-2000 88
Figure 44 Internet Computer Intensity by School Type 1998-2000 90
Figure 45 Internet Computer Intensity 92
Figure 46 Internet Computer Intensity by Poverty Level 93
Figure 47 Internet Computer Intensity by Minority Enrollment 94
Figure 48 Internet Computer Intensity by Student Need Indicator 95
Figure 49 Internet Access Connection Type 1998-2000 97
Figure 50 Internet Access by Location 1998-2000 98
Figure 51 Computers With Internet Access by Location 100
Figure 52 Teachers Using the Internet 103
Figure 53 Schools by Percentage of Teachers Using the Internet for Instruction 104
Figure 54 Online Curriculum Content Subscribers 107
Figure 55 Schools by Percentage of Teachers With E-Mail Addresses 108
Figure 56 Teachers Using E-Mail 110
Figure 57 CD-ROM Intensity 114
Figure 58 CD-ROM Intensity by School Type 1998-2000 115
Figure 59 CD-ROM Intensity by Minority Enrollment 116
Figure 60 Videodisc Player Penetration by School Enrollment 1998-2000 120
Figure 61 Schools With Videodisc Players 122
Figure 62 Schools With Media Retrieval Systems 126
Figure 63 Teachers Using Computers Daily 130
Figure 64 Schools by Percentage of Teachers Using Computers Daily 131
Figure 65 Teachers: Technology-Use Skill Level 1998-2000 132
Figure 66 Expectations for Technology Spending 136
Figure 67 Technology Spending 137
Figure 68 TSI by Enrollment 141
Figure 69 TSI by School Type 141
Figure 70 TSI by Metro Class 142
Figure 71 TSI by Student Demographics 143
Figure 72 TSI by Technology Penetration 145
Figure 73 TSI by Technology Penetration (continued) 146
Figure 74 TSI by Computer Intensity 147
Figure 75 TSI by Teacher Use of the Internet for Instruction 150

List of Tables

Table 1 Computer Intensity 23
Table 2 Computer-Intensive Schools 29
Table 3 Computer-Intensive Schools by School Type 31
Table 4 Computer-Intensive Schools: School Type by School Enrollment 31
Table 5 Computer-Intensive Schools: School Type by Minority Enrollment 32
Table 6 Computer Brand Share 1996-2000 33
Table 7 Predominant Computer Brand by School Type 33
Table 8 Schools With Processor Types by Poverty Level 36
Table 9 Schools With Power Mac Computers 38
Table 10 Schools by Location of Computers 40
Table 11 Location of Computers by School Type 40
Table 12 Computers by School Type and Location 42
Table 13 Schools Offering Computer Access by School Type 44
Table 14 Schools Using Windows 45
Table 15 Windows Users Penetration: School Type by School Enrollment 47
Table 16 Windows Users Penetration: School Type by Metro Class 47
Table 17 Multimedia Computers: Percentage of Installed Base 49
Table 18 Multimedia Computer Intensity 52
Table 19 Classrooms With Multimedia Computers by School Type 57
Table 20 Multimedia-Intensive Schools 58
Table 21 Multimedia-Intensive Schools: School Type by School Enrollment 60
Table 22 Multimedia-Intensive Schools: School Type by Minority Enrollment 60
Table 23 Schools With LANs 63
Table 24 LAN Penetration: School Type by School Enrollment 66
Table 25 LAN Penetration: School Type by Poverty Level 66
Table 26 LAN Penetration: School Type by Computer Intensity 67
Table 27 Networked Computer Intensity 68
Table 28 Quantity of Computers on LANs by School Type 73
Table 29 Networked Classrooms by School Type 73
Table 30 Network System by School Type 74
Table 31 Schools With WANs 76
Table 32 WAN Penetration: School Type by School Enrollment 78
Table 33 WAN Penetration: School Type by Metro Class 79
Table 34 WAN Penetration: School Type by Percentage of Classrooms Networked 79
Table 35 WAN Penetration: School Type by Computer Intensity 80
Table 36 WAN Penetration: Metro Status by Poverty Level 80

11

Table 37 Internet Access Penetration: School Type by School Enrollment 84
Table 38 Schools With Internet Access 85
Table 39 Internet Access Penetration: School Type by Poverty Level 87
Table 40 Internet Access Penetration: School Type by Student Need Indicator 89
Table 41 Internet Access Penetration: School Type by Computer Intensity 89
Table 42 Internet Computer Intensity 91
Table 43 Internet Access Connection Type by Student Need Indicator 97
Table 44 Internet Access by School Type and Location 99
Table 45 Classrooms With Internet Access by School Type 100
Table 46 Teachers Using the Internet 102
Table 47 Online Curriculum Subscribers by School Type 105
Table 48 Online Curriculum Content Subscribers 106
Table 49 Teachers Using E-Mail 109
Table 50 CD-ROM Intensity 113
Table 51 Schools With CD-ROM Drives by Platform 117
Table 52 Schools by Location of CD-ROM Drives 117
Table 53 Schools With DVD Drives by School Type 118
Table 54 Schools With Videodisc Players 121
Table 55 Videodisc Penetration: School Type by School Enrollment 123
Table 56 Videodisc Penetration: School Type by Poverty Level 124
Table 57 Media Retrieval System Penetration: School Type by School Enrollment 124
Table 58 Schools With Media Retrieval Systems 125
Table 59 Teachers Using Computers Daily 129
Table 60 Training-Intensive Schools: School Type by School Enrollment 133
Table 61 Training-Intensive Schools: School Type by Poverty Level 134
Table 62 Technology Spending 137
Table 63 TSI by Minority Enrollment 144
Table 64 TSI by Poverty Level 144
Table 65 TSI by Processor Type 148
Table 66 TSI by CD-ROM Intensity 148
Table 67 TSI by Internet Connection Type 149
Table 68 TSI by Internet Access Location 150

Introduction

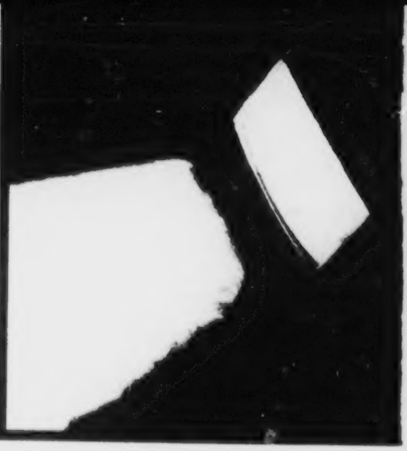
This report presents the results of Market Data Retrieval's (MDR) comprehensive annual survey of the technology market in public K-12 education. Conducted during the 1999-00 school year, the objective of the survey was to gather comprehensive, current, and consistent information on the use of various technologies in the nation's public schools. Each year the MDR survey asks schools to respond to essentially the same questions about their access to and use of computers, CD-ROMs, networks, Internet, and other technologies, such as satellite dishes and videodisc players. This consistency facilitates year-to-year comparisons and the analysis of long-term trends. At the same time, each survey is adjusted to capture information on new trends and emerging markets. In 1997-98 MDR focused on professional development activities. The 1998-99 survey added questions on technology spending, gathering data that allowed MDR to estimate the total size of the educational technology market. In 1999-00 the survey continued the emphasis on the extension of various technologies to the classroom level as well as continued focus on professional development activities.

The MDR 2000 Technology Survey reached all 87,700 public schools in the United States, using direct mail, telephone, and Internet survey techniques. Approximately 34% or 30,200 public schools responded, and this report is based on a representative sample of this group.

The findings from MDR's annual technology surveys have been published in a series of reports. *Technology in Education 1998* documented the wide acceptance of the Internet, and *Technology in Education 1999* began to document the story of the "digital divide"—the disparity in access to technology that exists between schools serving predominantly poor and minority students compared to those serving more affluent populations with low minority enrollments. *Technology in Education 2000* further explores the story of the "digital divide." Simply stated, students in the less advantaged schools have less access to technology. There are more students sharing each PC in use, fewer networks are in place, and fewer PCs are connected to the Internet. The gaps are, on the whole, quite small. But in a world where the ability to gather and analyze information, to work collaboratively, and to use computers and telecommunications technology is central to one's future success, any inequity is unacceptable.

This report is organized in two main sections. The Executive Summary presents highlights of the 1999-00 survey data. The second section provides a detailed analysis of the 1999-00 survey data. This analysis is presented in a format very similar to that used in *Technology in Education 1999*, in order to facilitate any detailed comparison readers of both sources may wish to make. An additional chapter this year introduces MDR's new Tech Sophistication Index™ (TSI), an indicator that provides a measure of how schools rank in terms their overall technology profile.

As the leading provider of education information and marketing services, MDR has been collecting data on schools for over 30 years and, more specifically, on technology use for more than 18 years. MDR's technology surveys have established a series of benchmarks against which to judge the progress of technology adoption and use in the American public schools. Analyzing data on building- and classroom-level penetrations and student-to-computer ratios, these surveys and their accompanying reports present a comprehensive picture of the true level of technology use in the public schools. In addition, the technology data is matched to MDR's extensive district and school demographic data (e.g., minority enrollment, poverty level), allowing for more interesting patterns of technology use to be examined.



Executive Summary

The Clinton Administration articulated the first set of national technology goals in February of 1996 with the announcement of the Technology Literacy Challenge. At the heart of that challenge were four goals: providing training and support for all teachers to help students learn how to use computers and the Internet; putting modern multimedia computers in all classrooms; connecting every classroom to the Internet; and making effective software and online learning resources an integral part of every school's curriculum. These goals were formalized and became a central element of the nation's first educational technology plan, *Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge*, which was issued by the U.S. Department of Education in June 1996.

The schools have made tremendous progress toward achieving those goals. The dream of connecting every school in America to the Internet has become a reality and is rapidly expanding as schools move from having just a central point of connectivity to extending Internet access to individual classrooms. Internet access continues to grow, increasing from 90% of all schools in 1999 to 94% in 2000. Classroom access is growing as well. The rate of school acceptance and penetration is unprecedented, rapidly approaching saturation levels.

And the Internet is just one aspect of the schools' technology mix. More than 85% of all schools and districts now report that they use LANs and CD-ROMs. Sixty-four percent or more use WANs and videodisc technology. Nearly one-third of schools use satellite technology. Twenty percent now employ media retrieval systems to facilitate the distribution of multimedia resources throughout their buildings. These technologies and others are all part of the schools' instructional materials arsenal, along with books, movies, radio and television, and a wide range of community-based resources, such as museums, fine arts groups, and the skills and experience of parents and other adults. Schools need to remain focused on the fact that technology is just another tool. When used thoughtfully to support and extend the teaching and learning process, it can be a powerful catalyst for change and improvement.

Thanks in part to the Internet, public interest in school technology is at an all-time high and federal and state funds continue to be appropriated to support school technology use. Federal funding alone is estimated to be between $1 to $1.5 billion annually. Although the federal share of overall education spending is small at 6.6%, the federal government's share of technology spending is estimated to be closer to 35%. Parents and the business community remain convinced that students being prepared for life in the 21st Century must be technology literate.

Recognizing the progress that has been made, the Department of Education is in the process of revising the national educational technology plan. The Department notes that the public's interest in the use of technology in education has been spurred by the "widespread recognition of the transformation technology is having on the American economy, as well as the potential for technology to transform the teaching and learning experience." The strategic review and revision of the technology plan is scheduled for completion by fall 2000. Emerging priorities have been identified as likely to be pivotal in any successful effort to increase the effective use of technology in education. These priorities include:

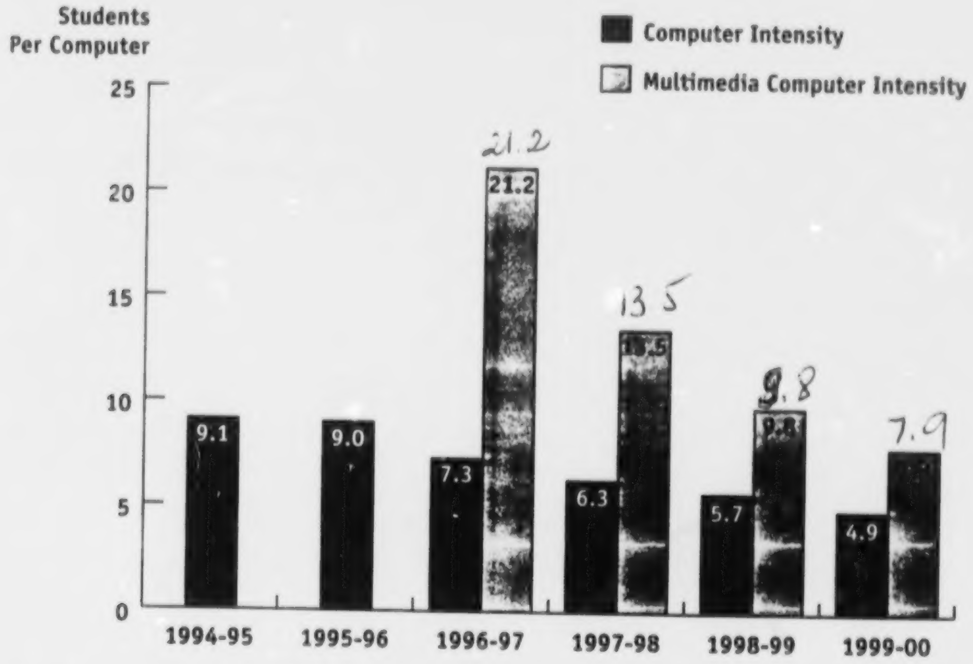
- All students and teachers will have universal access to effective information technology in their classrooms, schools, communities, and homes.
- All teachers will effectively use technology.
- All students will be technologically literate and responsible cybercitizens.
- Research, development, and evaluation will shape the next generation of technology applications for teaching and learning.

These priorities outline some of the continuing challenges the schools face as they strive to realize the promise of technology to improve the learning process. Over the past few years the public has been asking for proof that their investment in technology has paid off. Schools must begin to focus on the ways in which technology supports their efforts to improve instruction and help all students reach the higher academic standards that have been mandated. Schools will need to continue to respond to the demand for professional development, budgeting funds to support ongoing technology training that is site-based, sustained, and focused on teaching with technology. Ideally, training should be designed and directed by teachers who have successfully integrated technology in the curriculum in order to improve student learning. And since the rate of technology advancement does not abate, schools will also need to continue to update and augment their base of technology equipment if the goal of universal access is to be achieved.

The schools have made remarkable progress in providing basic computer access to their students. In the period between 1995 and 1999, the schools improved their computer intensity ratios by nearly half, improving student access from 1995's level of 9.1 students to one computer to 1999's level of 5.7 students to one computer. In 2000 they sustained that improved access, reaching a ratio of 4.9 students to one computer. But those ratios, based on the schools' total computer inventory, include a number of computers that are not up to handling the demands of today's computing environment. Looking solely at the multimedia computer environment, once again the schools have made significant progress. Schools' multimedia computer intensity improved significantly between 1997 and 1999, from 21.2 to 9.8 students per multimedia computer. In 2000 the schools were able to improve that ratio even more, with an average of 7.9 students per multimedia computer. (See Figure 1.) Since many current school computer purchases are of multimedia computers, multimedia computer intensity can be expected to continue to improve. However, it is possible that over the next several years, schools will begin to rely on the network and the Internet to deliver multimedia content. That development would change the concept and importance of multimedia computer intensity.

Figure 1

Computer Intensity Levels 1995-2000



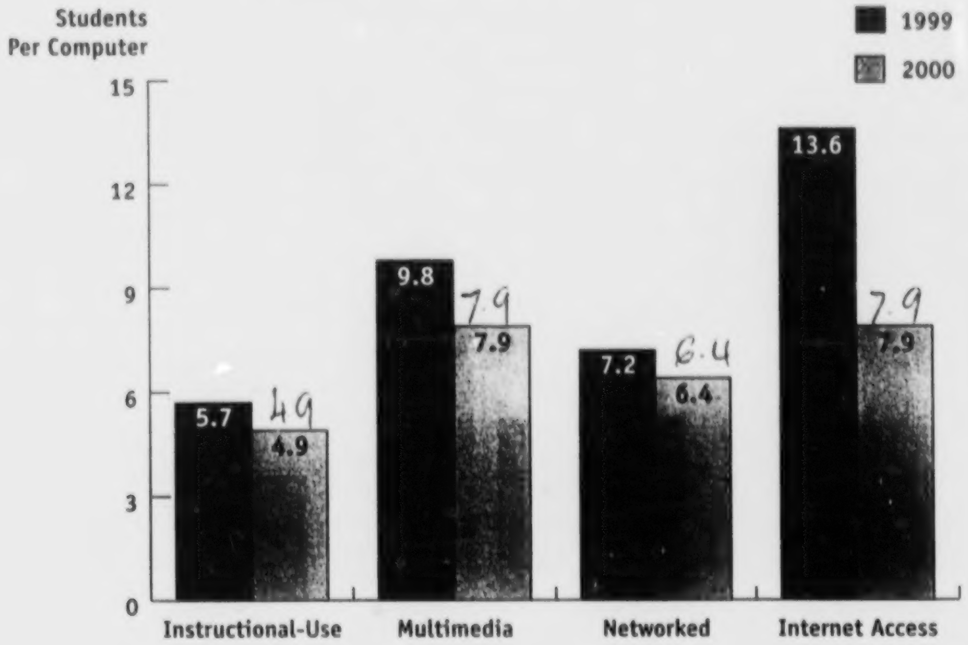
Source: Market Data Retrieval, 2000, Public School Findings.

The computers in use in American schools are rapidly being upgraded and networked, resulting in a transformation of the installed base. Multimedia computers, defined by the presence of a sound card and CD-ROM drive, make up 58% of the current installed base of instructional-use computers. Seventy-one percent of the installed base are connected to LANs and 58% are connected to the Internet. More than 65% of the Wintel computers in use are based on Pentium 586 or Pentium II class microprocessors and 80% are running Windows 95 or Windows 98. Fifty-one percent of schools using Macintosh computers own Power Macs. Students are increasingly able to count on having access to computers that are able to run sophisticated software programs, access the Internet, and support collaborative learning activities.

Though computer intensity of all types has improved significantly, there is still progress to be made. While student access to computers and to computers that are connected to a network is quite favorable, access to multimedia computers and computers that have access to the Internet is somewhat more limited. On average 7.9 students share every computer connected to the Internet. There are also 7.9 students for every multimedia computer in the installed base. (See Figure 2.)

Figure 2

Computer Intensities 1999-2000



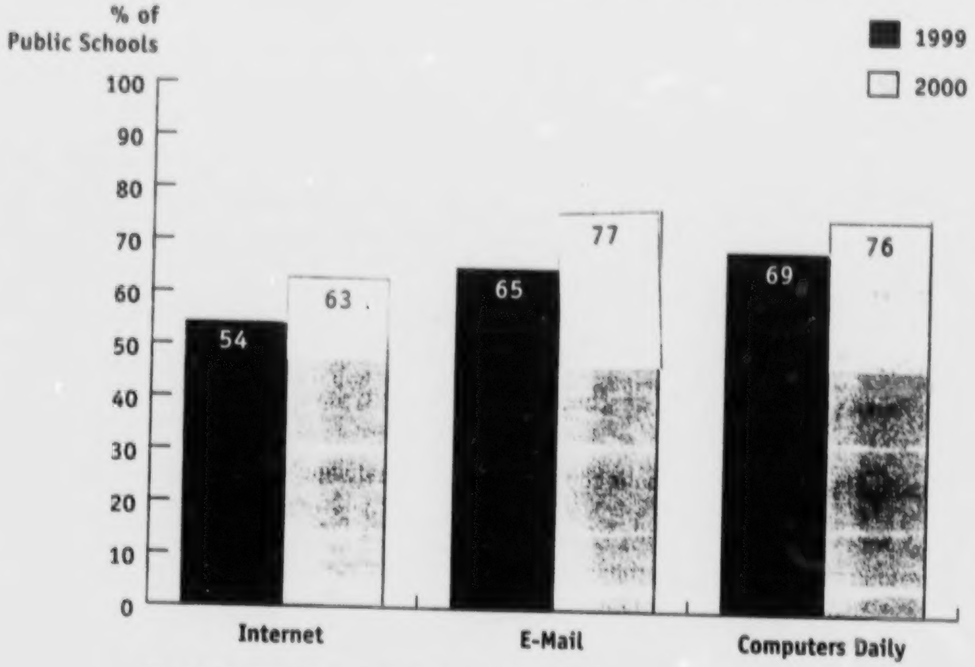
Source: Market Data Retrieval, 2000, Public School Findings.

Schools continue their efforts to place technology in classrooms. Teachers with computers in their classrooms are better able to plan for integrating computer-based activities into their ongoing instructional program. Nearly every school (98%) now reports placing at least some of their computers in classrooms. More than half of the installed base of computers are found in classrooms. Schools are also moving rapidly to extend network and Internet connections to classrooms as well. More than 80% of schools provide Internet access in classrooms, and nearly half of the installed base of computers with Internet access are in classrooms.

As technology becomes more ubiquitous and moves into classrooms, teachers are in a better position to become technology users. Tools that are readily available are more likely to be used. Knowing the technology is available and that it is under their control, teachers are able to integrate technology use into ongoing curriculum planning and daily lesson plans. This past year saw a significant increase in the percentage of schools that report that the majority (50%+) of their teachers are technology users. More than 75% say that the majority of their teachers use computers on a daily basis. More than 60% of all schools report that the majority of their teachers use the Internet for instructional purposes. And 77% of schools indicate that the majority of their teachers have school-based e-mail addresses. (See Figure 3.)

Figure 3

Teachers: Use of Selected Technologies 1999-2000



Should be read as: In 63% of all schools, the majority (50% or more) of the teachers are using the Internet for instructional purposes.

Source: Market Data Retrieval, 2000. Public School Findings.

In addition to the challenges of improving access, integrating technology to support teaching and learning and delivering professional development, the schools face one more significant challenge. Equity, in terms of student access to computers, has long been a concern for the technology community and the schools. As computers and telecommunications technology become a central component not only of classroom learning but of the workplace and everyday life, it becomes more important than ever that all students have access to the technology tools that will allow them to become productive citizens of the 21st Century.

Do all students have equal access to technology? Students in schools with high percentages of minority students have less access to computers. Schools with over 50% minority enrollments average 5.5 students per computer compared to 4.2 students per computer for schools with fewer than 5% minority enrollments. Only 29% of schools with minority enrollments of 50% or more are multimedia computer intensive (i.e., at or better than the student to multimedia computer average of 7.9:1) compared to 43% of schools with fewer than 5% minority enrollments. Schools with 50% or more minority enrollments average 9.4 students per multimedia computer compared to 6.9 students per multimedia computer for schools with fewer than 5% minority enrollments.

Schools with high minority enrollments fare even worse with respect to Internet computer intensity. Schools with 50% or more minority enrollments average 10.5 students per Internet-connected computer compared to 6.4 students per computer for schools with fewer than 5% minority enrollments. Schools in districts with high percentages of minority enrollments also report lower percentages of Internet access. Teachers in high minority schools also appear to be using the Internet to a lesser extent. Eighteen percent of high minority enrollment schools report that the majority of their teachers (50%+) use the Internet for instructional purposes compared to 32% of low minority enrollment schools.

Schools in districts with higher percentages of poverty-level students also report having less access to most types of technology. High poverty-level schools report lower percentages of multimedia computer-intensive schools, lower percentages of LAN penetration and of Internet access. These schools also seem to have higher percentages of older and less powerful computers in place. For example, while only 13% of schools with low poverty-level enrollments own computers based on the 286 chip, 20% of schools at the highest poverty levels own 286-based PCs. Overall, however, these schools appear to be more rapidly closing the gap between them and their more affluent counterparts.

It would appear that minority and poorer students have more limited access to technology-based resources. Students in schools with high percentages of minority students are at a particular disadvantage. And the extent to which resources are unevenly distributed contributes to growing concerns about the "digital divide"—the gap between those with full access to the opportunities technology makes available and those with little or no access. Since it is likely that these same students have little or no access to technology in their homes and fewer resources available in their immediate community, it is even more important that schools provide full and equal access. And though a gap still exists between poor and more affluent schools and students, the gap is closing.

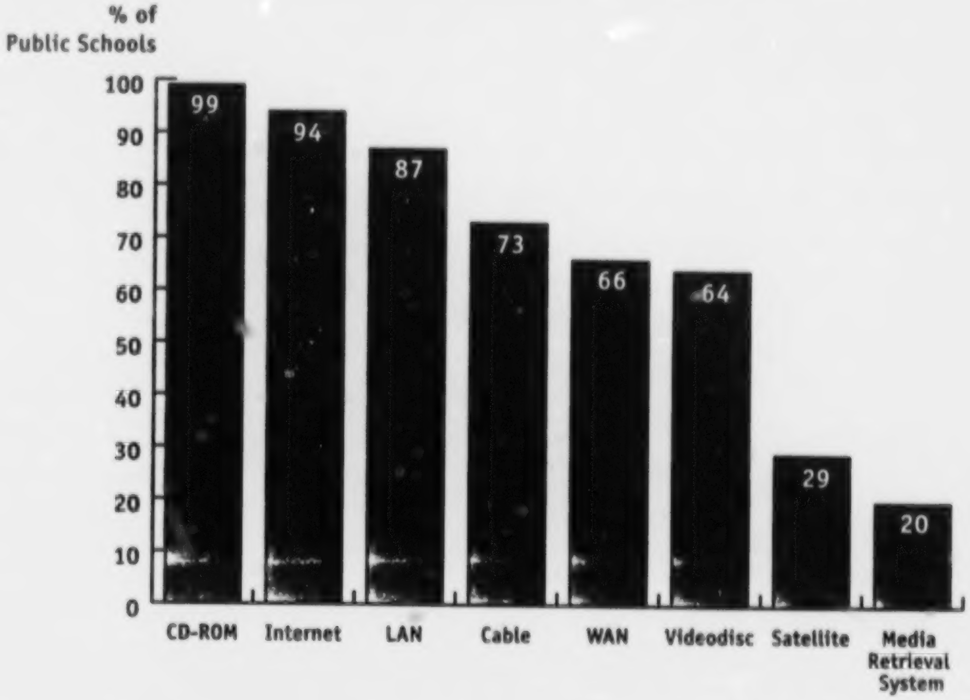
The chapters that follow examine the current usage levels of a variety of technology products. Each is examined in terms of a range of school demographic characteristics, such as enrollment, grade level, poverty level, etc. As has been true during the initial stages of technology adoption, enrollment and grade level remain the most reliable predictors of technology use. In general, the higher the grade level and the larger the school, the likelier that school is to own a given technology. But as penetration for technologies such as CD-ROM, multimedia, and networking approaches saturation, the effect of even grade level and size is dampened. Elementary schools are rapidly closing the gap that used to separate them from high schools. Small schools are nearly as likely to use selected technologies as are large schools.

Technology Overviews

Figure 4 details the school penetration levels of the various technologies. CD-ROMs record the highest penetration level at 99%, followed by the Internet at 94%. Eighty-seven percent of schools have LANs and 73% have access to cable. More than 60% use WANs and videodiscs. Satellite dishes record a building-level penetration of 29%, followed by media retrieval systems, which are found in 20% of all schools.

Figure 4

Technology Overview by School-Level Penetration

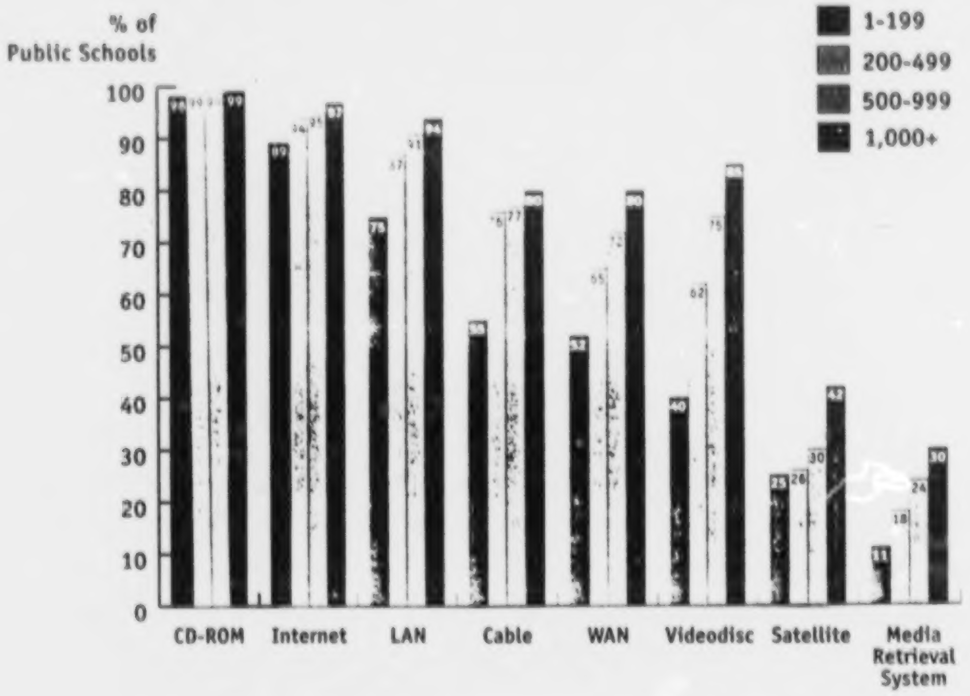


Source: Market Data Retrieval, 2000, Public School Findings.

As noted earlier, enrollment has been one of the more reliable indicators of technology use. As Figure 5 shows, this continues to be the case. Large schools are more likely to own any given technology than are small schools. For CD-ROM, which is approaching saturation, the gap between the percentage penetrations of the smallest and largest schools has essentially closed. The smallest schools are at a decided disadvantage in terms of their use of LANs, WANs, and videodisc technology. Cable penetration is also low among small schools, many of which are located in rural, low-density population areas that are not served by cable.

Figure 5

Technology Overview: Schools by Enrollment



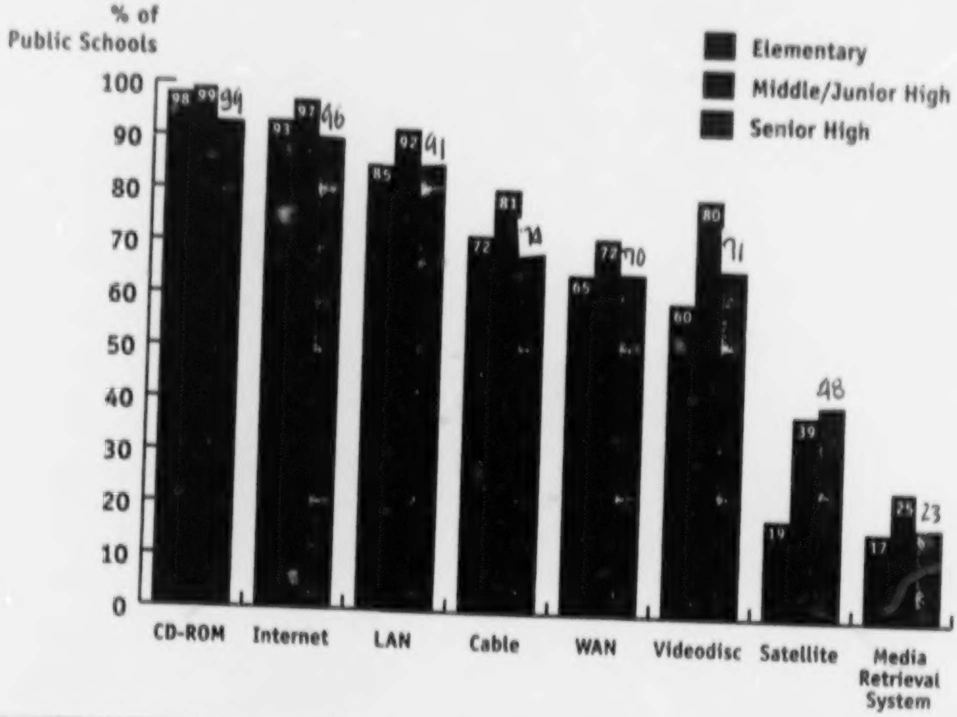
Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Grade level has been another reliable indicator of technology use. Senior highs are typically more likely to own a given technology than are elementary schools. As Figure 6 shows, though, this effect is beginning to be dampened. Middle/junior high schools are now almost as likely to own any given technology as are senior high schools. The classic stair-step penetration pattern appears only for satellite dish use. Satellite dishes have traditionally been used to bring advanced classes, such as calculus, to high school students in small or isolated settings. Because much of satellite-delivered programming is aimed at older students, penetrations remain higher among schools serving older students. For CD-ROM, grade level differences have all but disappeared. Elementary schools are quickly closing the gap with respect to the Internet, LAN and WAN use, while the middle/junior high and senior high school penetrations are nearly even. Elementary schools lag in terms of the penetration of media retrieval systems. Middle/junior high schools continue to record the highest level of videodisc use, in part a reflection of the type of videodisc software that is available.

Figure 6

Technology Overview by School Type

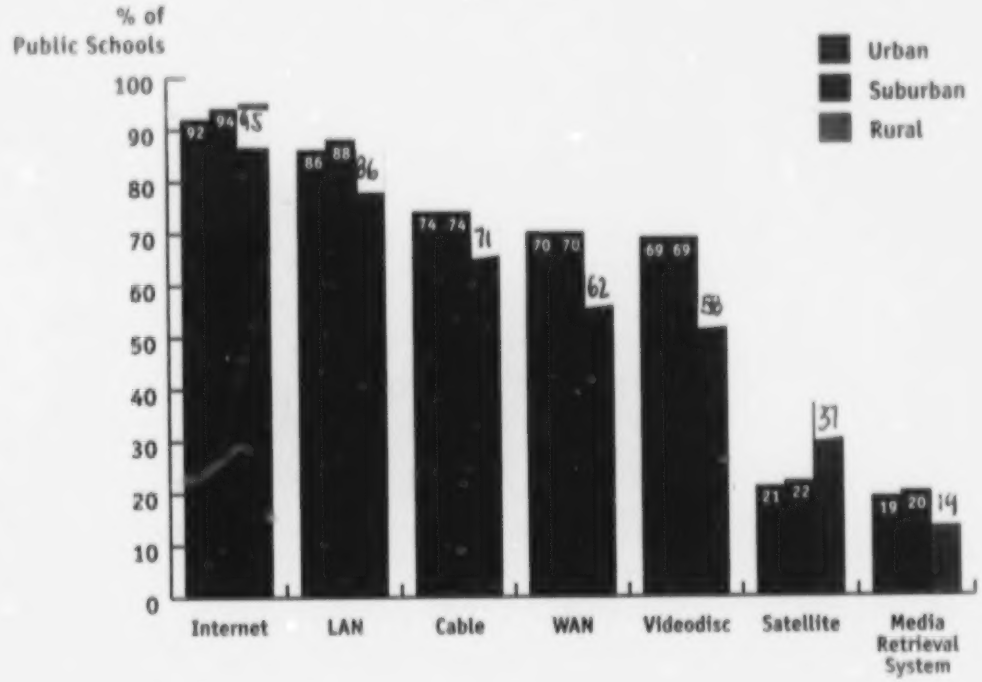


Source: Market Data Retrieval, 2000, Public School Findings.

School location, in terms of metro class, appears to have little impact on technology use, as can be seen in Figure 7. Rural schools are somewhat less likely to use most technologies, but the differences are relatively minor, except for WANs and videodisc. And rural schools are the most likely to report the use of satellite dishes. For these rural schools, many of which are not served by cable, the satellite dish delivers the equivalent of cable programming. It also makes possible the delivery of interactive distance learning, bringing advanced instruction to schools otherwise unable to offer such classes. Satellite technology has also begun to be used to deliver Internet connectivity, since advanced telephone services in many rural areas are severely limited and very expensive.

Figure 7

Technology Overview: Schools by Metro Class

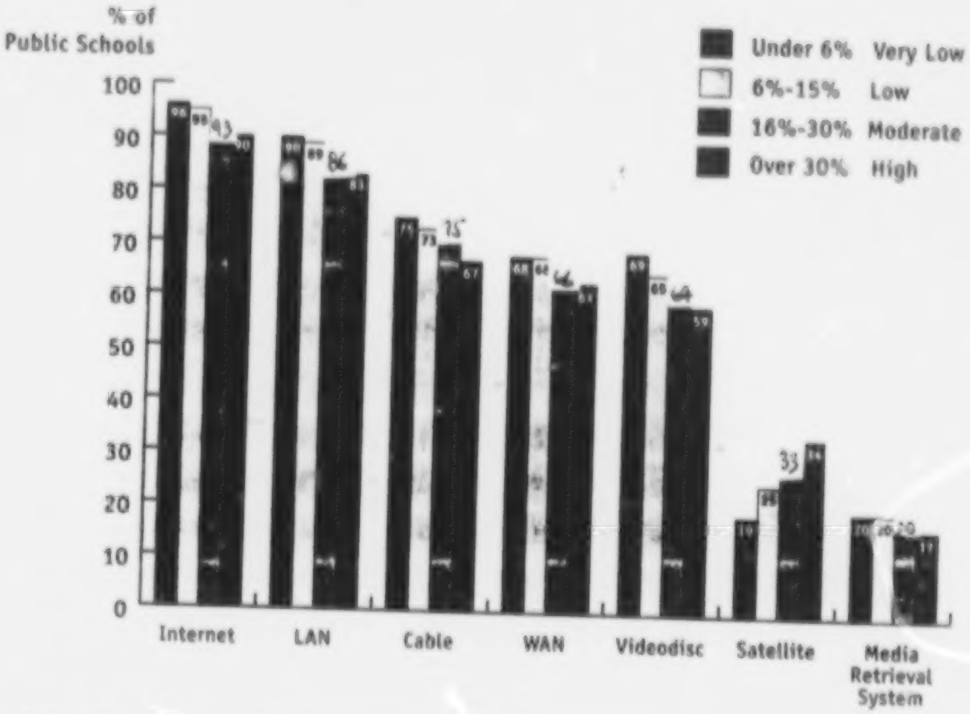


Source: Market Data Retrieval, 2000, Public School Findings.

Do all students in U.S. public schools have the same level of access to educational technology? The data suggests that students attending schools in poorer districts have less access to technology than do their peers in schools located in more affluent districts. As Figure 8 shows, schools in districts with low percentages of poverty-level enrollments are the most likely to report using most technologies. But here, too, the gap is closing. The discrepancy in levels of access are strongest for LANs, with 90% of schools in districts with under 6% poverty-level enrollments having LANs compared to 83% of schools in districts with over 30% poverty-level enrollments. Conversely, schools in districts with higher percentages of poverty-level students are much more likely than their affluent counterparts to use satellite dish technology. It appears that satellite dishes are perceived as cost-effective ways to gain access to resources outside the schools' walls. With the E-rate discount program now in place, the gap that had existed in Internet use tightened and should probably close rapidly. The E-rate program provides discounts ranging between 20% and 90% toward internal connections, Internet, and telecommunications services, with the poorest schools and libraries receiving the deepest discounts. Further explanation about the E-rate program is included in the Internet chapter.

Figure 8

Technology Overview: Schools by Poverty Level



Summary Results

Computers for Instructional Use

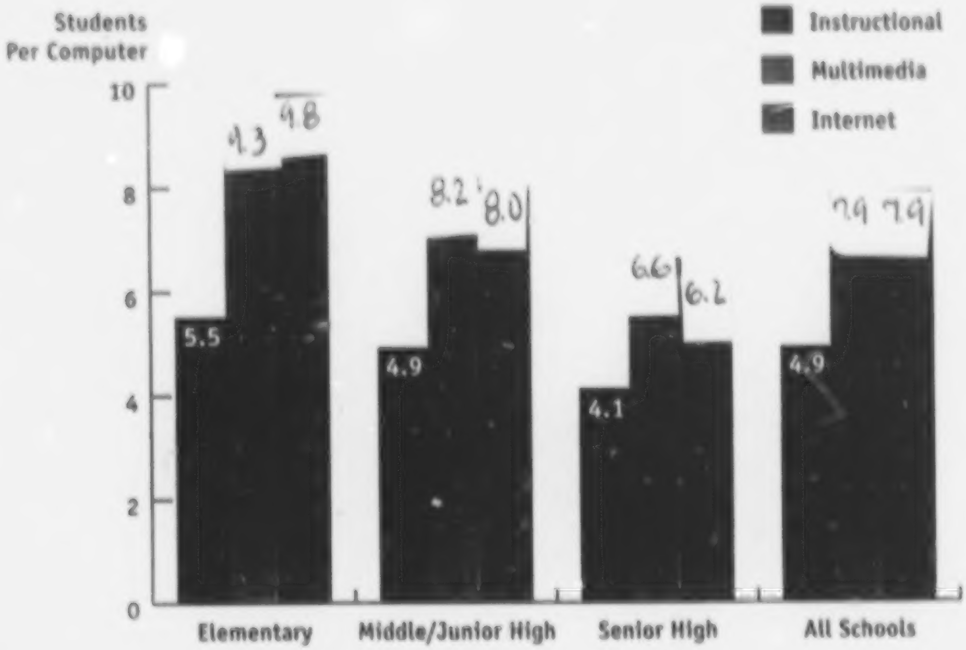
During the past five years, the number of computers for instructional use in public schools has doubled, from 4.9 million units in 1994-95 to today's total of 9.8 million.

Computer intensity, defined as the ratio of students to instructional-use computers, continues to improve. A decade ago, public schools had 24.1 students per computer. Five years ago that figure was 9.1 and today it is 4.9 students per computer. As can be seen in Figure 9, senior high schools offer the most favorable computer intensities, followed by middle/junior high and elementary schools.

In 2000, 43% of all public schools are computer intensive. These schools have a student-to-computer ratio at or better than the national average of 4.9 students per computer.

Figure 9

Computer Intensity by School Type



Source: Market Data Retrieval, 2000, Public School Findings.

Multimedia Computers

Multimedia computers, defined by the presence of a sound card and CD-ROM drive, make up roughly 58% of the current installed base of instructional-use computers. More than 97% of U.S. public schools own at least one multimedia computer.

Multimedia computer intensity, at 7.9 students per multimedia computer, is less favorable than the 4.9 students per computer that applies to the total installed base of instructional-use computers. (See Figure 9.)

Windows Use

Eighty-one percent of schools report using Windows. Both school size and school type are strong determining factors in Windows use. More high schools use Windows (95%) than do elementary schools (75%). The largest schools report a significantly higher penetration of Windows use than do smaller schools.

Sixty-three percent of the Wintel computers in the installed base are running under Windows 95 and another 17% have made the upgrade to Windows 98.

LANs

Eighty-seven percent of all schools use LANs. LAN use is impacted by both school size and school type. Roughly 94% of the largest schools use LANs, as do 91% of senior high schools. This pattern may reflect the fact that large schools of all types and high schools have available more technical support and resources to support the implementation of a local area network.

WANs

Sixty-six percent of schools report access to a WAN, a slight rise from 1999 when 64% of schools reported WAN access. The schools remaining without WAN access may be in locations where it will take some time for the district or state to expand the network. As was true for LANs, WAN use is also strongly impacted by school size. Roughly 80% of the largest schools use WANs.

Internet Access

Internet access continues to climb with 94% of all public schools reporting access in 2000. Ninety-seven percent of middle/junior high schools and 96% of senior high schools have Internet access compared to 93% of elementary schools. School size is a strong determinant of Internet access. Ninety-seven percent of the largest schools have Internet access compared to 85% of the smallest schools.

Internet computer intensity is 7.9 students per computer with Internet access. Senior high schools report the most favorable Internet computer intensity (6.2), while elementary schools have the least favorable ratio (9.8).

Internet Use for Instruction

Sixty-three percent of public schools indicate that the majority (50%+) of their teachers use the Internet for instructional purposes.

Thirteen percent of schools subscribe to some form of online curriculum content, with middle/junior high and senior high schools being more likely to be subscribers than elementary schools.

CD-ROM

Ninety-nine percent of all schools now use CD-ROM drives. CD-ROM intensity is currently 7.3 students per CD-ROM drive. This number is expected to continue to improve now that CD-ROM drives are standard features of most computers sold to the school market.

Roughly 5% of schools report owning PCs equipped with DVD-ROM drives.

Videodiscs

Sixty percent of elementary schools, 71% of senior high schools, and 80% of middle/junior high schools use videodiscs. The ability to easily use a videodisc player to support large group, lecture-style presentations seems to appeal to teachers at the secondary level.

Teacher Skill Level and Technology Use

Forty-two percent of schools report that virtually all (90% or more) of their teachers use computers daily for instructional planning or teaching.

More than 45% of schools report that the majority of their teachers (50% or more) can be identified at the intermediate skill level with respect to computer use. Intermediate users are able to use a variety of computer applications but are not adept at integrating technology into the curriculum.

Technology Expenditures

Total estimated technology spending for 1999-00 is $5.67 billion or $121.37 per student. The bulk of technology spending is directed to hardware, accounting for 63% of total technology spending. Schools spend 20% of their technology budgets on software and 17% is devoted to staff development.

Definition of Terms

Following are a set of definitions of the various independent variables referred to throughout the report. They are offered to assist readers in establishing a framework within which to interpret the findings.

Computer Intensity

This is the number of students per instructional-use computer.

Computer-Predominant Brand

Identifies schools by the predominant brand of computers (brand must have a two-to-one or better ratio) being used for instructional purposes. Not every school has a predominant brand. Brands include Apple II, Macintosh, and PC instructional computers.

E-Rate

E-rate refers to the program established by the Federal Communications Commission to implement the Universal Service requirement of the Telecommunications Act of 1996. Provisions of that act required that schools and libraries receive access to advanced telecommunications services and mandated that they receive discounts on these services. In May 1997 the FCC issued an order that established the E-rate (education rate), which covers commercially available telecommunications services (such as voice and data service), internal connections that are necessary for bringing the technology into each classroom, and Internet access. Discounts range from 20% to 90% (60% is average) and are based on geographic location and economic disadvantage.

Media Retrieval Systems

Media retrieval systems allow schools to distribute media content from a central location to classrooms throughout the building.

Metro Status

Metro status divides districts and schools into three areas (urban, suburban, and rural) based on Metropolitan Area (MA) classification and population.

Minority Percentage

Minority percentage represents the total percentage of students in a public school belonging to minority groups, including African American, Asian, American or Alaskan Indian, and Hispanic.

Multimedia Computer

A multimedia computer is defined by the presence of a CD-ROM drive and sound card.

PC and Wintel

The designation PC was adopted to conform to industrywide usage. It stands for the class of computers that previously had been identified as IBM/Compatible. These machines are characterized by the presence of an Intel or Pentium-class processor and use Windows operating systems. For this reason they are sometimes referred to as Wintel machines.

Poverty Level

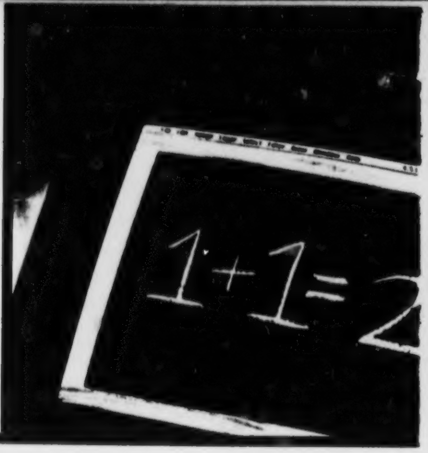
Poverty level represents the percentage of children in the district from families below the poverty line based upon 1990 Census data.

Student Need Indicator

Student need indicator represents the percentage of a public school's enrollment which qualifies for the free lunch program. Updated yearly, qualification for free lunch is based on family size and income criteria. The lower the percentage, the better the economic situation in the households of the students attending the school.

Technology Sophistication Index™ (TSI)

TSI is a measure of the overall technology infrastructure of a school relative to the number of students in that school. The TSI measures not only the amount of technology in a school but also the level of student access to that technology. All schools (public, private, and Catholic) are divided into five equal groups, from the most sophisticated in terms of their technology profile to the least sophisticated.



Computers for Instructional Use

Computer and telecommunications technologies are transforming business, commerce, entertainment, and the social environment. Technology has the potential to transform the classroom as well. Already the concept of e-learning, the ability to use digital media to learn anytime and anyplace, has been embraced by business and higher education. While students in the K-12 environment have increasingly more access to computers and telecommunications, technology-based learning does not dominate the K-12 scene. For the most part, technology remains peripheral to the curriculum and the classroom learning environment.

It is possible that computers will not become fully integrated into the curriculum until they become as common as textbooks or pencil and paper—tools that students and teachers take for granted in today's classrooms. While the student-to-computer ratio has improved steadily over the years, now standing at roughly one computer for every 5 students, that still limits student access. The schools are beginning to explore a number of alternative ways of extending access to technology.

The concept of one-to-one learning is taking hold in a number of places. In this model, students are typically provided with a laptop computer they may use at both school and home. For example, in schools managed by the Edison Project, every student from third grade up has his or her own laptop. NetSchools' one-to-one e-learning model gives every student in the program a specially designed laptop that includes basic tool applications and connects to a wireless network to access the Internet. These one-to-one programs are expensive models, based on the belief that systemic and measurable impacts on academic achievement can be expected only when technology is fully integrated with the education program. And integration requires consistent and ready access to the technology for every student and teacher.

Other schools are experimenting with mobile carts that provide the one-to-one learning experience in a more limited manner. When teachers have a specific goal in mind, they can schedule the use of a mobile cart that allows every student in their class to have a computer to accomplish the learning task. The computers used in this implementation can vary from fully featured standard laptops through sub-notebooks, such as EarthWalk's eBuddy laptop or the DreamWriter IT, a full-sized portable that runs Windows CE and allows students to send and receive e-mail, browse the Web, and use standard productivity tools. The mobile carts recharge and secure the laptops when not in use and provide power and a wireless interface that helps eliminate the cost for additional network drops and electrical wiring.

A variety of handheld devices, similar to those that are so ubiquitous in the business environment, are also under development. Palm Inc. announced an increased focus on the education market at the National Educational Computing Conference (NECC) in June 2000, where they and other Palm solution providers demonstrated mobile Palm OS-compatible applications for educators, students, and parents. Vendors such as ImagiWorks, Infinity Softworks, Inc., and Sunburst Technologies are developing curriculum-related applications and learning tools for student use. Symbol Technologies markets a line of products that integrate Symbol's miniaturized barcode laser scanning technology into the Palm form factor. The devices are designed for data capture, display, and communication and provide all the functionality of a Palm III. Teachers can use the devices and a wireless network to enter attendance and grade information and manage safety measures on campus. Scanning a student ID card returns a student's school schedule, allowing teachers to monitor student activity. Sylvan Learning recently announced a joint venture with Aether to develop and license technology for handheld wireless units that students would keep with them throughout the day to communicate with each other and with teachers. The solution would provide basic collaboration, communication, and messaging applications and could be used to take attendance and to access assignments, schedules, and educational content. Parents could use the communication network to check children's attendance, grades, assignments, and teachers' comments.

Certainly, platform options are going to continue to proliferate. The challenge for schools will be to select equipment that meets specific computing needs. Students may use portable handheld devices for data gathering and communications purposes; portables and desktops for class work and research; and powerful multimedia servers for projects, multimedia productions, and other high-end uses. The degree of access students have to computers is an important element in the success of any school's instructional technology program. And the extent to which resources are unevenly distributed contributes to growing concern about the "digital divide"—the gap between those with full access to the opportunities technology makes available and those with little or no access.

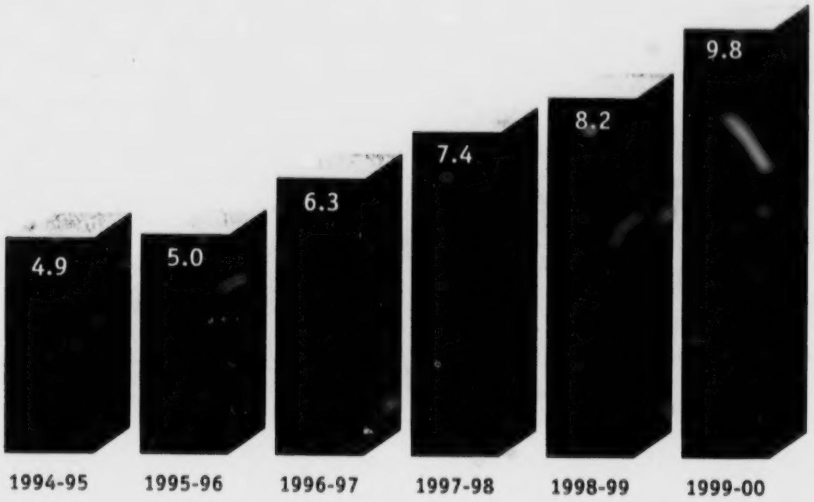
Installed Base – Quantity Projections

During the past five years, the number of computers for instructional use in public schools doubled, from 4.9 million in 1994-95 to 9.8 million in 1999-00.

There has been a significant increase in the installed base over the prior school year. In 1998-99 the installed base of instructional computers in public schools stood at 8.2 million units. Since 1998-99, schools added 1.6 million instructional-use machines to their inventories, bringing the installed base to 9.8 million. The schools appear to be rising to the challenge of providing increased access to state-of-the-art technology. (See Figure 10.)

Figure 10

Computer Inventory 1995-2000
(In Millions)



Source: Market Data Retrieval, 2000, Public School Findings.

Computer Intensity

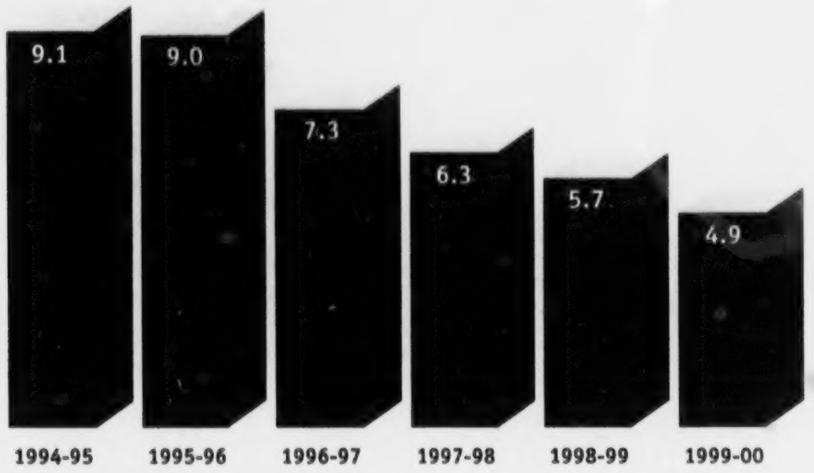
One measure of the schools' success in providing students with sufficient access to technology is computer intensity—the ratio of students to instructional-use computers. As the installed base of instructional computers grows, student access to computers continues to improve. Computer intensity improved from a ratio of 9.1 students per computer in 1994-95 to 4.9 students per computer in 1999-00. (See Figure 11.)

The improvement in computer intensity was significant this past year. On average, the number of students sharing each instructional-use computer was reduced by almost one person. Still, students are not assured of ready access to the latest state-of-the-art technology. While the number of older computers included in the installed base continues to shrink, access can also be affected by the way equipment is distributed and scheduled, as in the case of computer labs. However, given the increased purchase rate over the past year, the schools are becoming more successful in making modern computers available where and when students need them.

Figure 11

Computer Intensity 1995-2000

(Students Per Computer)



Source: Market Data Retrieval, 2000, Public School Findings.

Computer intensity varies by state, ranging from a favorable 3.0 students per computer in Wyoming to a less favorable 7.2 in California. (See Table 1 and Figure 12.) Among the states with computer intensities better than the national average of 4.9 students per computer are Indiana (3.7), Idaho (3.8), West Virginia (3.9), Florida (4.2), Kentucky (4.2), Texas (4.3), Ohio (4.4), Pennsylvania (4.6), Washington (4.7), Virginia (4.7), and Georgia (4.7), each of which has invested heavily in instructional technology.

In Kentucky and West Virginia, a statewide plan for education includes an emphasis on technology as a vehicle for educational reform, improved student performance, and future economic viability. In Pennsylvania, Virginia, and Iowa, the governors have been strong advocates for technology. The legislatures in Indiana, Florida, Washington, Texas, Idaho, and Ohio have committed significant state resources to fund technology, while Georgia devotes a substantial portion of lottery proceeds to educational technology purchases. Other states with favorable computer intensity ratios, such as Delaware (4.4), North Dakota (3.6), South Dakota (3.2), Montana (3.1), and Wyoming (3.0), benefit from low student populations, which allows a relatively modest investment in technology to go a long way.

New initiatives in Maine (4.6), New Jersey (4.6), Arizona (4.8), and Illinois (4.9) have allowed these states to effect a significant improvement in their computer intensity ratios, moving from above the national average in 1998-99 to at or below the national average in 1999-00. Although slightly above the national average, Alabama improved its computer intensity level from its 1998-99 ratio of 7.0 to a 1999-00 ratio of 5.0.

Table 1

Computer Intensity

	State	Students Per Computer	
Least Access	California	7.2	
	Louisiana	6.8	
	Rhode Island	6.5	
	Mississippi	6.4	
	Nevada	6.1	
	New Hampshire	6.1	
	District of Columbia	5.8	
	Hawaii	5.8	
	Maryland	5.6	
	Utah	5.5	
	Connecticut	5.4	
	Tennessee	5.4	
	New York	5.3	
	Massachusetts	5.2	
	North Carolina	5.2	
	Oregon	5.2	
	Arkansas	5.1	
	Michigan	5.1	
	Alabama	5.0	
	South Carolina	5.0	*National Average 4.9*
	Illinois	4.9	
	New Mexico	4.9	
	Vermont	4.9	
	Arizona	4.8	
	Georgia	4.7	
	Virginia	4.7	
	Washington	4.7	
	Colorado	4.6	
	Maine	4.6	
	New Jersey	4.6	
	Oklahoma	4.6	
	Pennsylvania	4.6	
	Missouri	4.5	
	Delaware	4.4	
	Ohio	4.4	
	Texas	4.3	
	Florida	4.2	
	Kentucky	4.2	
	Minnesota	4.2	
	West Virginia	3.9	
	Idaho	3.8	
	Iowa	3.8	
	Alaska	3.7	
	Indiana	3.7	
	Nebraska	3.7	
	Wisconsin	3.7	
	North Dakota	3.6	
	Kansas	3.3	
	South Dakota	3.2	
	Montana	3.1	
Greatest Access	Wyoming	3.0	

Source: Market Data Retrieval, 2000. Public School Findings.

Figure 12

Computer Intensity

Students Per Computer

■ Under 4.3 Students

■ 4.3-4.9 Students

■ Over 4.9 Students

2000 National Average: 4.9 Students

BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

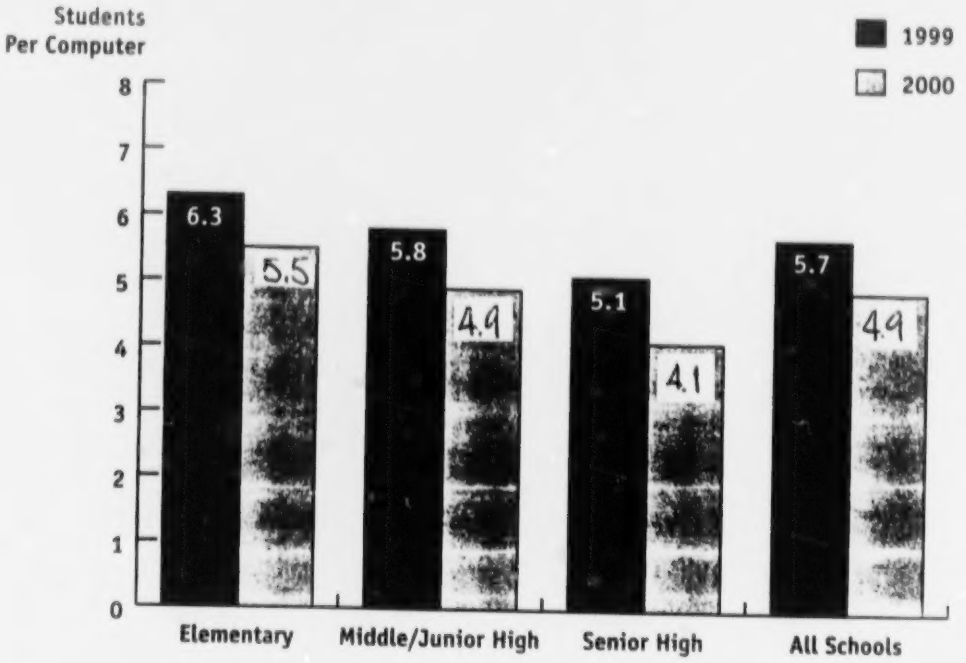
Though the states with computer intensity ratios less favorable than the national average continue to improve their overall standing from year to year, it can be difficult to effect a significant change, especially in states with large student populations and above-average enrollment growth. Though California has invested significant amounts of money in technology over the past three years, it has proven difficult to make up for years of limited budgets. The same is true for Louisiana, Mississippi, and Nevada. The relatively unfavorable computer intensity ratios in New Hampshire (6.1), the District of Columbia (5.8), and Hawaii (5.8) reflect limited local resources.

School Type

Student access to computers varies by school type. Senior high schools continue to have the edge, with a more favorable student-to-computer ratio (4.1) than that of elementary schools (5.5). The same pattern was present in prior years. In 1999 senior high schools had a student-to-computer ratio of 5.1 compared to the elementary school ratio of 6.3. Slowly, however, the gap is closing, with elementary schools continuing to improve their ratio with respect to senior high schools.

Figure 13

Computer Intensity by School Type 1999-2000



Source: Market Data Retrieval, 2000 Public School Findings.

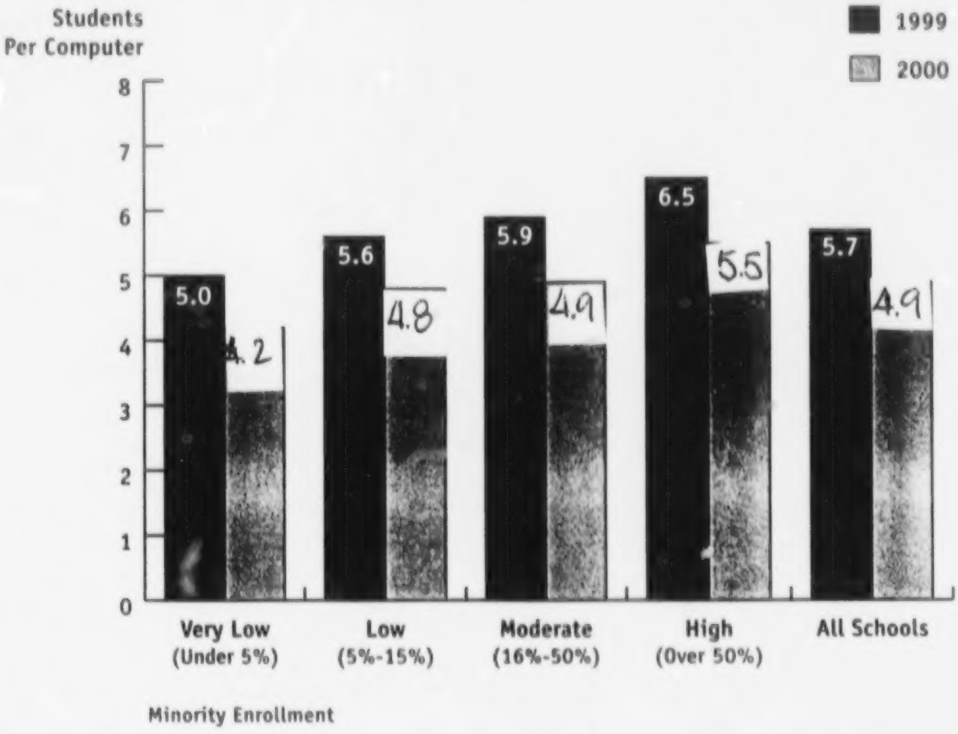
Minority Enrollment

Equity, in terms of student access to computers, has long been a concern for the technology community and the schools. Do all students have equal access to technology? One measure that can be used to examine this question is minority status.

Students in schools with high percentages of minority students have more limited access to computers. Schools with more than 50% minority enrollments average 5.5 students per computer compared to 4.2 for schools with fewer than 5% minority enrollments. Thus schools with high percentages of minority students have less favorable computer intensities than the national average of 4.9. They compare even less favorably to schools with low minority enrollments. While the digital divide continues to be a problem, it is encouraging to note that the largest improvements in student-to-computer ratios were recorded among schools with the highest percentage of minority enrollments.

Figure 14

Computer Intensity by Minority Enrollment 1999-2000



Source: Market Data Retrieval, 2000. Public School Findings.

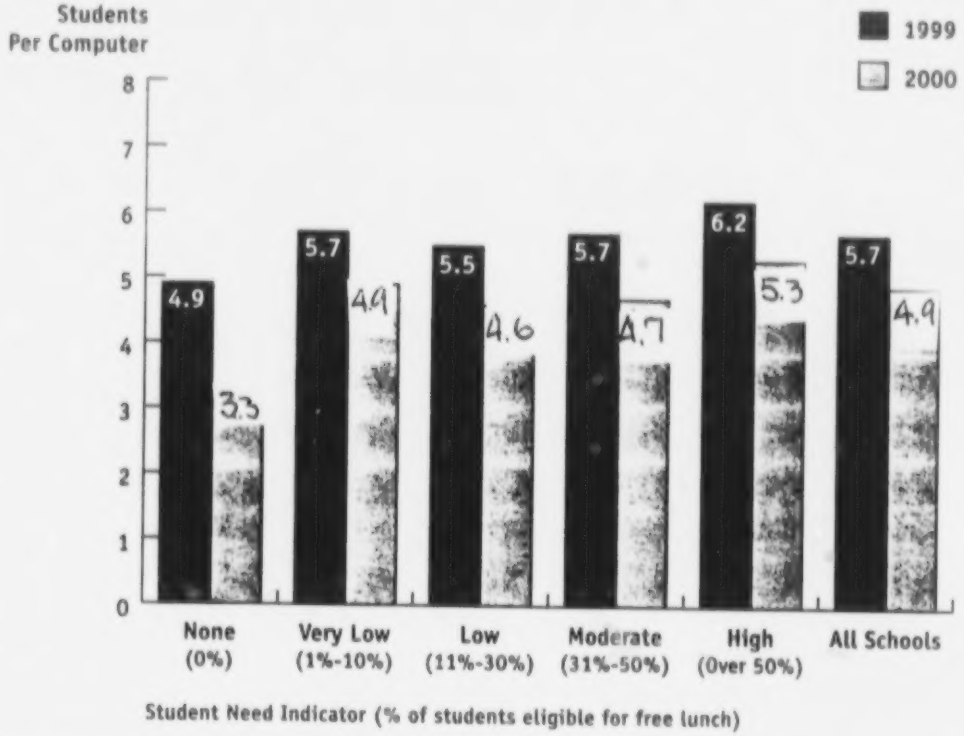
Student Need Indicator

Student need indicator represents the percentage of a public school's enrollment that qualifies for the free lunch program. Updated yearly, qualification for free lunch is based on family size and income criteria. The lower the student need indicator percentage, the better the economic situation in the households of the students attending the school.

Schools with higher percentages of students qualifying for free lunch also provide less access to computers for their students. Schools with high student need (more than 50%) average 5.3 students per computer compared to 3.3 for schools without any children who qualify for the free lunch program.

Figure 15

Computer Intensity by Student Need Indicator 1999-2000



Source: Market Data Retrieval, 2000, Public School Findings.

Computer-Intensive Schools

Computer-intensive schools are those that have a student-to-computer ratio at or better than the national average of 4.9 students per computer. As the student-per-computer average continues to improve, it becomes harder for school districts to bring all schools to that improved level of access. In 1999-00 less than half, 43%, of all public schools are computer intensive compared to 45% of all schools in 1998-99. Twenty-five states fall below the national average for computer-intensive schools. Table 2 and Figure 16 present the percentage of schools in each state that are computer intensive. Wyoming's student-to-computer intensity of 3.0 translates to 73% of Wyoming schools having 4.9 or fewer students per computer. Between 60% to 70% of all schools in West Virginia, Nebraska, North Dakota, Montana, Kansas, South Dakota, and Alaska have 4.9 or fewer students per computer.

At the other end of the computer intensity scale, only 21% of the schools in Rhode Island and fewer than 30% of the schools in Mississippi, California, Louisiana, New Hampshire, Alabama, Connecticut, and Hawaii can be characterized as computer intensive, with 4.9 or fewer students per computer.

Table 2

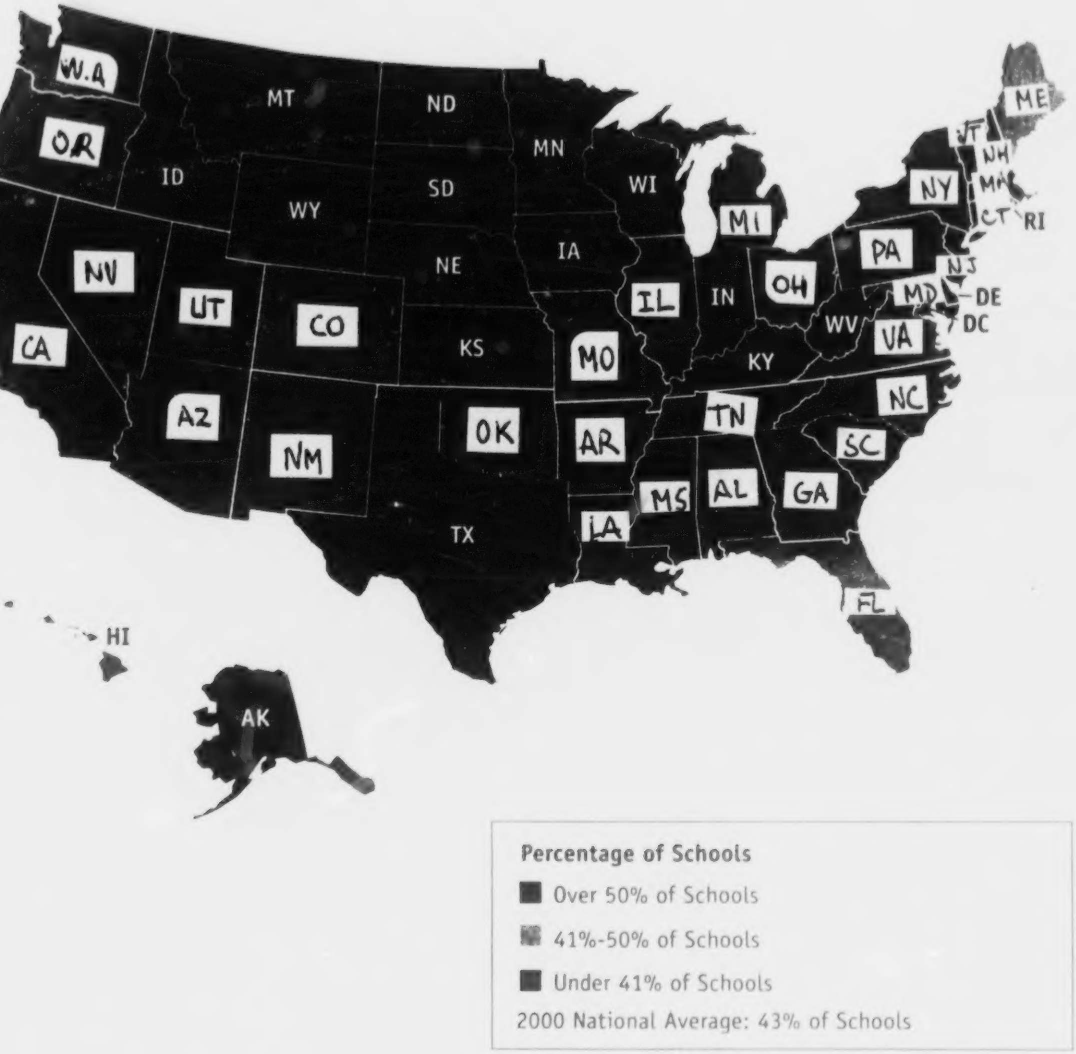
Computer-Intensive Schools

State	School Penetration (%)	
Wyoming	72.7	
Alaska	70.8	
South Dakota	67.9	
Kansas	66.8	
Montana	66.3	
North Dakota	65.7	
Nebraska	65.2	
West Virginia	61.6	
Wisconsin	58.1	
Iowa	56.4	
Idaho	55.9	
Indiana	54.9	
Kentucky	54.5	
Minnesota	53.8	
Texas	51.4	
New Mexico	49.3	
Florida	48.6	
Washington	48.4	
South Carolina	45.8	
Virginia	45.6	
Ohio	45.5	
Delaware	45.2	
Maine	45.2	
Colorado	44.7	*National Average 43.0%*
Missouri	43.0	
Georgia	42.9	
Oregon	42.1	
Illinois	40.4	
Arizona	40.3	
Nevada	39.6	
Pennsylvania	39.0	
Utah	39.0	
Vermont	38.6	
North Carolina	38.2	
Oklahoma	38.0	
New York	37.9	
New Jersey	37.2	
Tennessee	36.7	
Michigan	36.7	
Arkansas	36.0	
District of Columbia	35.3	
Massachusetts	32.6	
Maryland	31.2	
Hawaii	28.9	
Connecticut	27.8	
Alabama	26.7	
New Hampshire	26.6	
Louisiana	25.4	
California	25.2	
Mississippi	22.0	
Rhode Island	20.8	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 16

Computer-Intensive Schools



BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000. Public School Findings.

School Type

Fifty-six percent of senior high schools are computer intensive, averaging 4.9 or fewer students per computer, compared to 38% of elementary schools and 44% of middle/junior high schools. The high school advantage is even more striking due to the fact that senior highs, on average, have higher enrollments. However, some districts implement technology plans that offer the greatest access in newest technologies to the students on the brink of entering college or the workforce.

Nearly 70% of combined schools, serving grades K-12, are computer intensive. Some 32% of adult/special/voc. ed. schools are classified as computer intensive.

Table 3

Computer-Intensive Schools by School Type

School Type	School Penetration (%)
Elementary	38.3
Middle/Junior High	43.6
Senior High	55.5
Combined	67.1
Adult/Special/Voc. Ed.	31.8
Total	**43.0**

Source: Market Data Retrieval, 2000, Public School Findings.

School Type vs. School Enrollment

Higher percentages of schools with small enrollments, regardless of grade level, are computer intensive. Roughly 60% of schools with enrollments below 200 are computer intensive, averaging 4.9 or fewer students per computer, compared to 34% of large schools (1,000-2,499 students) and 18% of very large schools (2,500+ students). While only 38% of all elementary schools are computer intensive, 65% of the smallest elementary schools (under 100 students) are computer intensive.

Table 4

Computer-Intensive Schools: School Type by School Enrollment

School Type	All Schools (%)	1-99 (%)	100-199 (%)	200-299 (%)	300-499 (%)	500-999 (%)	1,000-2,499 (%)	2,500+ (%)
Elementary	38.3	64.5	57.6	47.9	36.7	26.5	18.4	-
Middle/Junior High	43.6	67.9	67.9	61.2	50.8	37.6	29.9	-
Senior High	55.5	50.8	73.8	69.7	64.4	55.0	40.3	18.6
Combined	67.1	53.3	81.9	78.8	68.4	56.9	52.9	-
Adult/Special/Voc. Ed.	31.8	59.3	32.9	16.4	12.2	10.9	25.0	-
Total	**43.0**	**59.1**	**62.4**	**53.5**	**42.0**	**33.1**	**33.5**	**17.5**

Source: Market Data Retrieval, 2000, Public School Findings.

Minority Enrollment

Schools with high percentages of minority students are less likely to be computer intensive. Only 36% of schools with 51% or more minority enrollments are computer intensive, averaging 4.9 or fewer students per computer, compared to 53% of schools with fewer than 5% minority enrollments. Thus lower percentages of schools with high percentages of minority students are computer intensive as compared to the national average of 43% of all schools. They compare even less favorably to schools with low minority enrollments.

Table 5

Computer-Intensive Schools: School Type by Minority Enrollment

School Type	All Schools (%)	0%-4.9% (%)	5%-15.9% (%)	16%-50% (%)	51%+ (%)
Elementary	38.3	47.3	37.7	37.0	30.7
Middle/Junior High	43.6	46.3	43.0	43.5	39.9
Senior High	55.5	65.1	54.0	54.8	47.2
Combined	67.1	77.0	73.1	69.3	66.9
Adult/Special/Voc. Ed.	31.8	47.6	33.3	55.4	53.4
Total	**43.0**	**52.8**	**42.5**	**42.4**	**35.9**

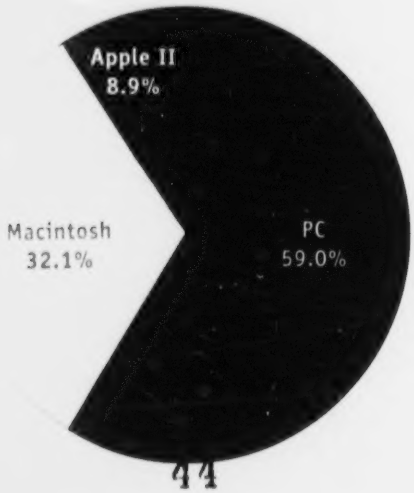
Source: Market Data Retrieval, 2000, Public School Findings.

Installed Base – Brand Shares

As was true last year, PCs claim more than half of the K-12 market. PCs now claim 59% of the installed base of instructional-use computers. Apple Computer commands 41% of the K-12 installed base of instructional-use computers.

Figure 17

Computer Brand Share



Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

The PC portion of the market has grown steadily during the past five years, increasing from 41% in 1995-96 to 59% today. Apple's overall share has declined, from 58% in 1995-96 to 41% today. The major shift occurred in the Apple II installed base, which slipped from 24% in 1995-96 to 9% in 1999-00. The retirement rate for Apple II machines has slowed, perhaps indicating that the Apple IIs remaining in the installed base are performing tasks that do not require more sophisticated equipment and will not be replaced or upgraded.

Table 6

Computer Brand Share 1996-2000

Computer Brand	**1995-96 (%)**	**1996-97 (%)**	**1997-98 (%)**	**1998-99 (%)**	**1999-00 (%)**
Apple II	23.6	19.4	13.4	9.4	8.9
Macintosh	34.2	34.9	36.7	34.8	32.1
PC	41.4	44.3	49.2	55.1	59.0
Other	0.8	1.4	0.7	0.7	–[1]
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[1] Other category is no longer compiled.

Source: Market Data Retrieval, 2000, Public School Findings.

Predominant Computer Brand

Apple's strength in the school market has traditionally been among elementary users, and though this remains true today, the pattern has weakened considerably. Increasingly, schools of all types are reporting that Wintel computers are their predominant computer brand. Only among elementary schools do fewer than 50% of schools report that Wintel computers are their predominant brand. While Apple has managed to hold the percentage of elementary schools where it is the predominant brand steady at around 35%, the percentage of elementary schools where Wintel computers dominate reached 41% this year. Meanwhile, Wintel computers continue to dominate the high school market. Thirty-five percent of elementary schools report that Apple II/Macintosh is the predominant brand of computer owned compared to 30% of middle/junior high schools and 13% of senior high schools. PCs are the predominant brand in 71% of high schools compared to 52% of middle/junior high schools and 41% of elementary schools.

Table 7

Predominant Computer Brand by School Type[1]

School Type	**Apple II (%)**	**Macintosh (%)**	**PC (%)**
Elementary	3.6	30.9	40.6
Middle/Junior High	1.1	28.8	51.7
Senior High	0.8	12.0	71.4
Combined	1.7	17.2	62.8
Adult/Special/Voc. Ed.	3.2	14.9	65.2
Total	**2.7**	**26.2**	**49.3**

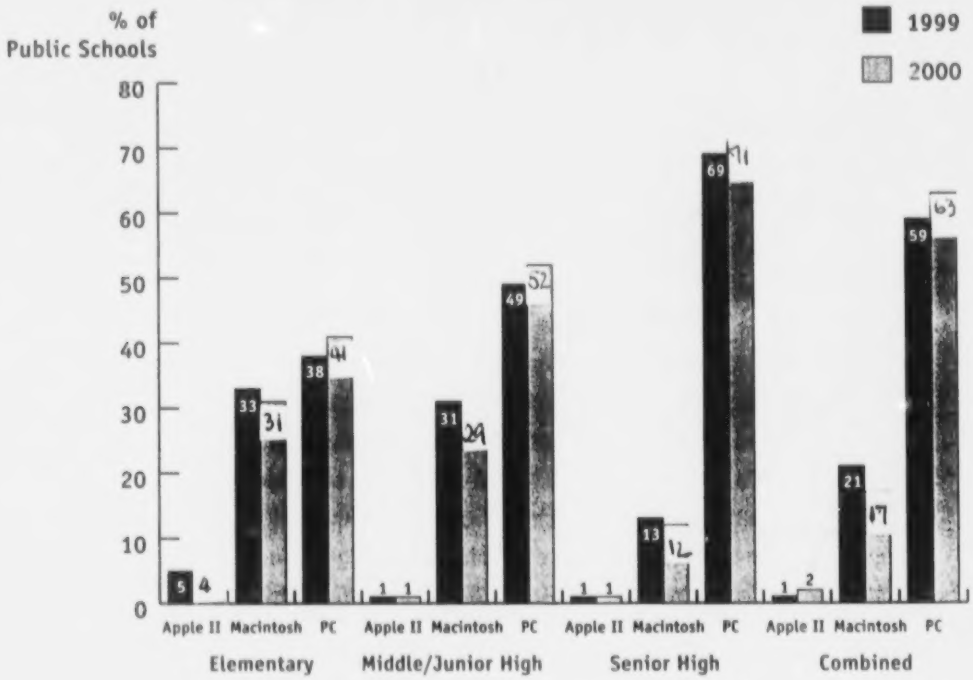
[1] Includes all schools with a predominant brand. Not every school has a predominant brand.

Source: Market Data Retrieval, 2000, Public School Findings.

The percentage of schools reporting that Apple II is their predominant brand has become negligible. But for the first time Apple has not increased the percentage of elementary schools in which the Macintosh is the predominant brand. The percentage of schools reporting PCs as their predominant brand continues to grow at all grade levels. Clearly, a higher number of formerly Apple-predominant schools have shifted into the PC camp. Among elementary schools, 38% reported Apple II/Macintosh as their predominant brand in 1999, falling to 35% in 2000. Elementary schools reporting PCs as their predominant brand increased from 38% in 1999 to 41% in 2000. Among senior high schools, 69% reported PCs as their predominant brand in 1999, growing to 71% in 2000. However, given the success of the Apple iMac since its introduction in 1998, Apple now has a new low-end computer in its arsenal of school products, which could help to hold its share steady or even increase.

Figure 18

Predominant Computer Brand 1999-2000



Source: Market Data Retrieval, 2000, Public School Findings.

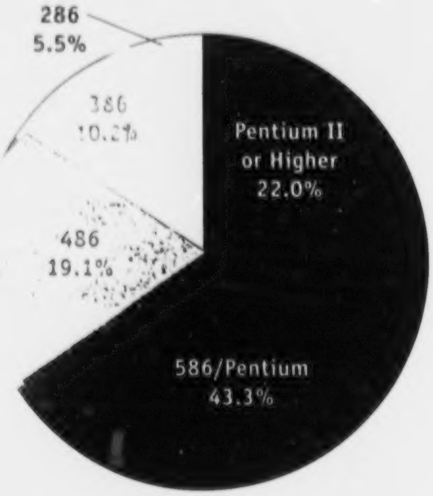
Processor Type

When examining the PC installed base, processor type helps determine capability. Like Apple IIs, older PCs, those equipped with 286 or 386 processors or even older (8-bit 8088 processors) are not able to run much of the software being designed and marketed today.

Schools that owned PCs were asked to indicate the number of machines owned of each processor type. While the installed base continues to be quite varied, there is increasing consolidation toward the higher end of the processor spectrum. The percentage of the PC installed base that is now based on Pentium II processors has more than doubled from 11% in 1999 to 22% today. The largest percentage of Wintel computers, 43%, are 586-based machines. Another 19% of the computers are 486s. Only 16% of the PC base is made up of 286 and 386 models. The trend toward the high-end computer will continue as vendors offer schools more powerful processors at prices comparable to or lower than current price points.

Figure 19

PCs by Processor Type



Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Poverty Level

Poverty level indicates the percentage of children below the poverty line in the district. The higher a district's poverty level, the poorer the community it serves.

Fewer schools in districts with higher percentages of poverty own Wintel computers with high-end processors. While 34% of schools in districts with under 6% poverty-level enrollments own Pentium II computers, 31% of schools in districts with over 30% poverty-level enrollments do so. Conversely, while only 13% of low poverty-level schools own 286s, 20% of schools at the highest poverty level own 286s. Similarly, while 26% of low poverty-level schools own 386s, 34% of schools at the highest poverty level own 386s. Fewer schools in districts with high percentages of poverty-level enrollments own computers with high-end processors than the national average. And they also compare even less favorably to schools with low percentages of poverty-level enrollments.

Table 8

Schools With Processor Types by Poverty Level

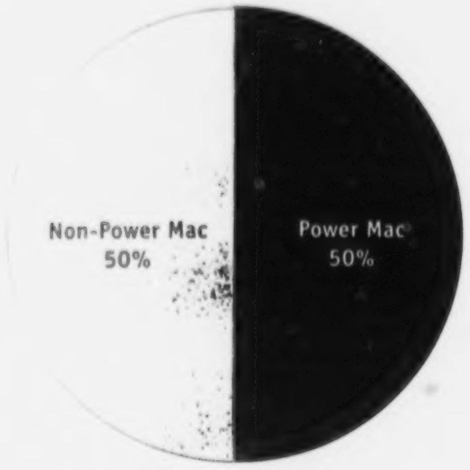
Poverty Range	286 (%)	386 (%)	486 (%)	586 (%)	Pentium II or Higher (%)
Under 6%	13.1	26.0	43.6	67.8	34.4
6%-15.9%	16.8	31.6	47.0	67.2	33.3
16%-30%	20.0	34.4	50.7	65.4	32.8
Over 30%	19.8	34.4	45.4	61.0	31.3
Total	**18.0**	**32.4**	**47.6**	**65.5**	**32.9**

Source: Market Data Retrieval, 2000, Public School Findings.

Schools that owned Macintosh computers were asked to indicate if they owned Power Macs or Non-Power Macintosh computers. The installed base is now evenly split between computers based on earlier Apple microprocessors and Power Macs.

Figure 20

Macintosh Computers by Processor Type



Source: Market Data Retrieval, 2000, Public School Findings.

Apple's Power Mac shows particular strength in a number of states, including Alaska, Hawaii, Minnesota, Wyoming, and Iowa. Fewer than 15% of schools in Arkansas, West Virginia, and Mississippi own Power Macs. Each of these states standardized on Wintel computers at some time in the past. (See Table 9 and Figure 21.)

Table 9

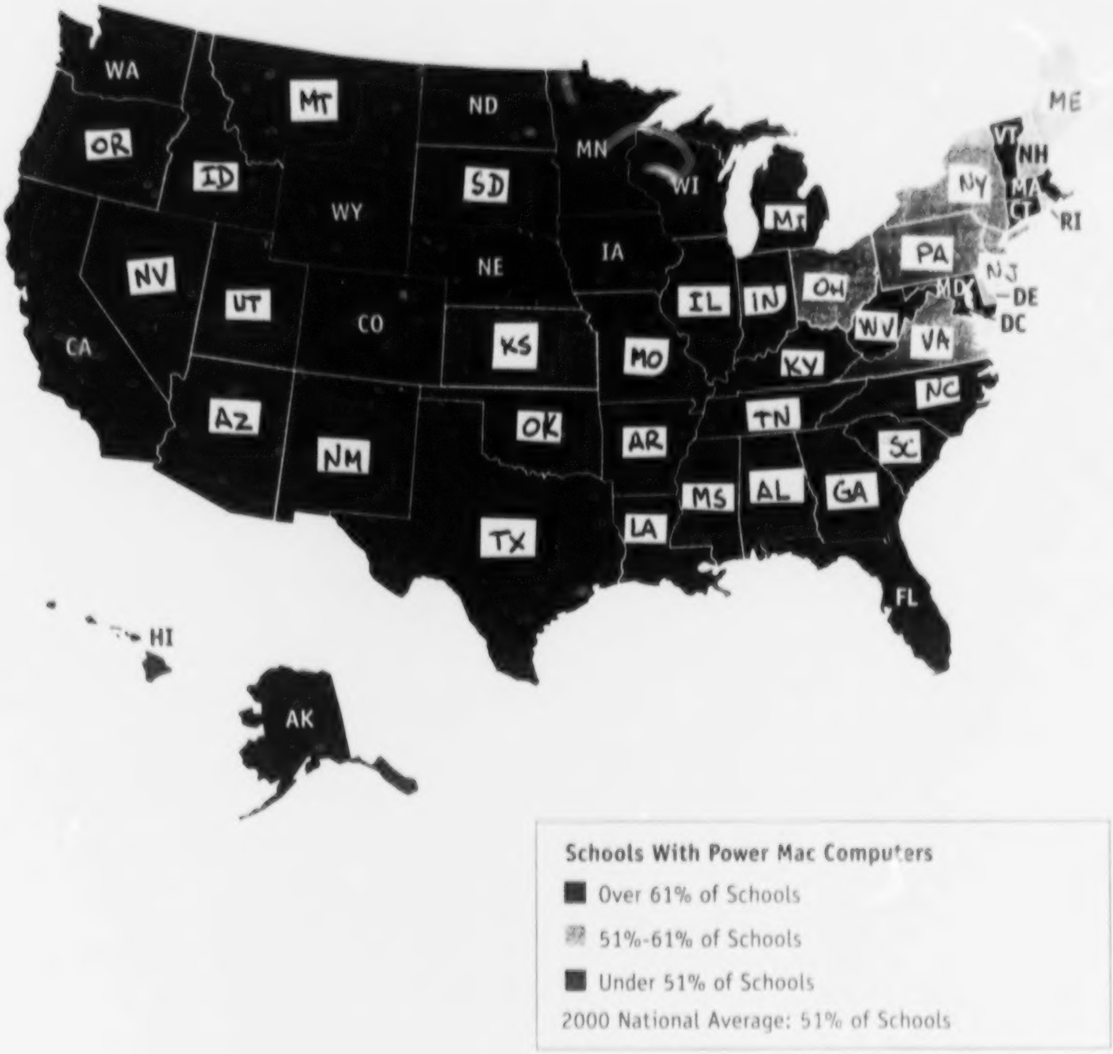
Schools With Power Mac Computers

State	School Penetration (%)	
Alaska	85.0	
Hawaii	82.2	
Minnesota	82.2	
Wyoming	81.8	
Iowa	79.6	
Washington	74.9	
District of Columbia	73.5	
Nebraska	70.6	
Wisconsin	69.5	
Colorado	66.0	
North Dakota	65.7	
Florida	65.7	
Vermont	65.1	
California	64.0	
Connecticut	63.8	
Massachusetts	63.6	
Maryland	61.9	
Oregon	61.5	
Pennsylvania	60.8	
New Hampshire	60.6	
Rhode Island	60.4	
Maine	57.6	
Nevada	57.1	
Utah	57.1	
New York	56.9	
Arizona	55.8	
Virginia	55.8	
Delaware	54.8	
Ohio	53.2	
Kansas	51.6	*National Average 50.9%*
New Jersey	50.5	
Montana	49.7	
Texas	49.4	
South Dakota	48.1	
Indiana	47.1	
North Carolina	46.3	
Illinois	46.2	
Michigan	44.6	
New Mexico	44.4	
Tennessee	44.4	
Georgia	39.4	
Missouri	34.1	
Louisiana	28.5	
Alabama	27.5	
Kentucky	26.1	
Oklahoma	25.2	
Idaho	24.8	
South Carolina	20.7	
Mississippi	13.5	
West Virginia	11.8	
Arkansas	10.4	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 21

Schools With Power Mac Computers



BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000. Public School Findings

Locations Within the School

Schools continue to report placing their instructional computers in a variety of locations. Virtually all schools (98%) now report that they place at least some computers in classrooms, 84% place computers in computer labs, and 84% in libraries/media centers. Eighteen percent report placing computers in other locations.

The significant increase in the number of schools reporting at least some computers in classrooms (from 93% in 1999 and 73% in 1998) completes the ongoing shift from the pattern of five years ago, when centralized facilities were considered optimal. Centralized labs allow for more intense use but require careful scheduling. Placing computers in classrooms gives teachers greater control of the computers and allows them to plan for greater integration with regular instruction.

Table 10

Schools by Location of Computers[1]

Location	School (%)
Classroom	98.4
Computer Lab	83.9
Library	83.9
Other	18.4

[1] Based on respondents who indicated location.

Source: Market Data Retrieval, 2000, Public School Findings.

Middle/junior high schools are the most likely to place at least some of their computers in computer labs. Ninety-seven percent of middle/junior high schools place at least some computers in computers labs, compared to 93% of senior high schools and only 79% of elementary schools. Middle/junior high school is the level at which students are most likely to be required to take courses focused on computer literacy/computer applications, classes that are taught to large groups of students in laboratory settings. Middle/junior high schools are also more likely to put at least some computers in libraries/media centers.

Table 11

Location of Computers by School Type[1]

School Type	Classroom (%)	Computer Lab (%)	Library (%)	Other (%)
Elementary	98.9	78.7	84.1	18.7
Middle/Junior High	97.9	97.1	93.5	18.0
Senior High	97.2	92.5	85.3	18.4
Combined	98.7	88.3	78.8	19.3
Adult/Spec/Voc. Ed.	97.3	71.0	36.7	14.8
Total	**98.4**	**83.9**	**83.9**	**18.4**

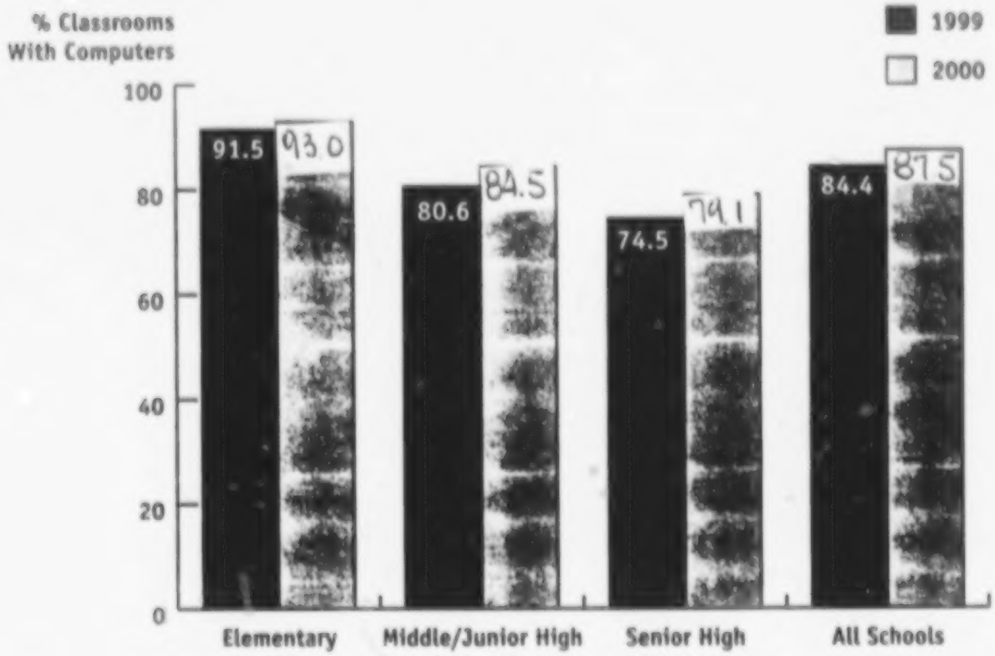
[1] Based on respondents who reported location. Should be read as: 98.9% of elementary schools reported computers are located in the classroom.

Source: Market Data Retrieval, 2000, Public School Findings.

Once a school makes the decision to place computers in its classrooms, the majority of classrooms are equipped with computers. Ninety-eight percent of schools indicated that they placed computers in classrooms. In those schools an average of 88% of classrooms have computers. Among schools placing computers in classrooms, elementary schools report the highest percentage of computer-equipped classrooms, 93%, followed by 85% of classrooms in middle/junior high schools and 79% of classrooms in senior high schools.

Figure 22

Classrooms With Computers by School Type 1999-2000



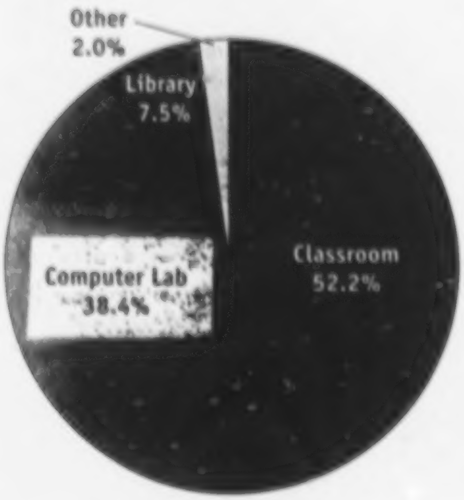
Should be read as: Within schools reporting at least one computer in a classroom, 87.5% of the classrooms have a computer.

Source: Market Data Retrieval, 2000. Public School Findings.

Though 84% or more of schools place computers in classrooms, computer labs, and libraries/media centers, the bulk of the installed base is distributed between classrooms and computer labs. (See Figure 23.) A higher percentage of the installed base is found in classrooms (52%) than in computer labs (38%). Nearly 8% of the installed base is found in libraries/media centers. Other locations claim roughly 2% of the installed base of computers. Though the absolute number of computers found in the schools increased significantly this year, the distribution pattern changed only slightly from last year. This may indicate that the schools find the current distribution optimal to their needs.

Figure 23

Computers by Location



Source: Market Data Retrieval, 2000, Public School Findings.

School Type

Elementary and middle/junior high schools place the majority of their computers, 59% and 48%, respectively, in classrooms. Senior high schools place the largest percentage of their computers, 47%, in computer labs. It is interesting to note that among middle/junior high and senior high schools, the installed base is more evenly divided between classrooms and computer labs. Fewer than one-third of the elementary school installed base is found in computer labs.

Table 12

Computers by School Type and Location[1]

School Type	Classroom (%)	Computer Lab (%)	Library (%)	Other (%)
Elementary	59.3	31.8	7.0	1.9
Middle/Junior High	48.1	41.4	8.4	2.1
Senior High	42.9	47.0	8.0	2.0
Combined	49.7	41.1	7.2	2.0
Adult/Special/Voc. Ed.	50.5	43.9	4.0	1.7
Total	**52.2**	**38.4**	**7.5**	**2.0**

[1] Based on respondents who indicated computers by location. **Should be read as:** In elementary schools, 59.3% of the computers are in the classroom.

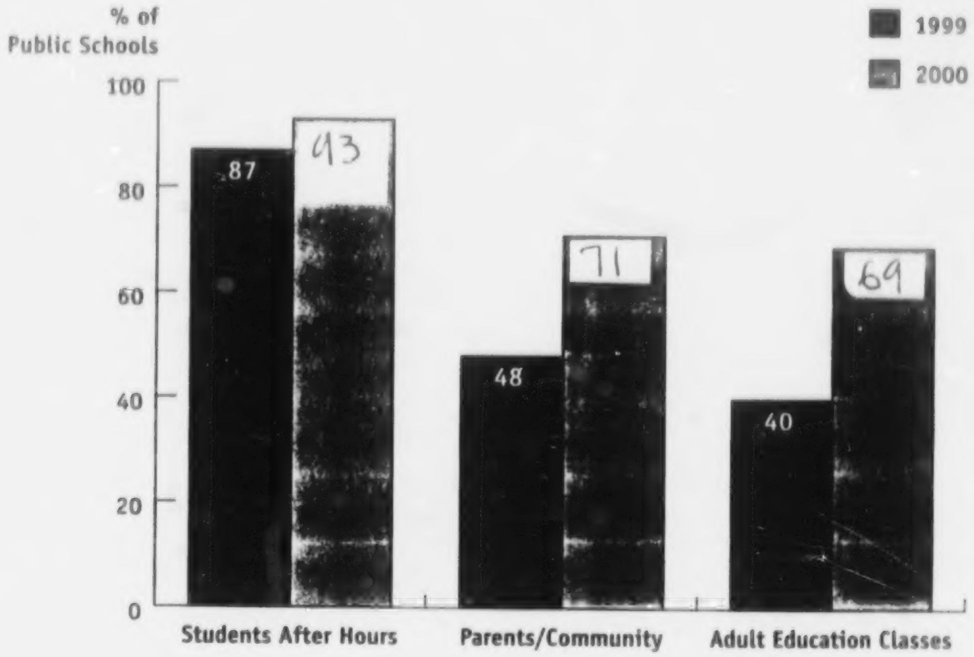
Source: Market Data Retrieval, 2000, Public School Findings.

Computers Available After School Hours

Schools are an important community resource. By making computers available outside of normal school hours or to groups other than traditional students, schools are able to maximize their technology investment. Ultimately their base of support for technology-related programs and the requisite funding required to run them is broadened. In some instances, schools receive some financial support in return for making computers available for use in adult education or community service programs. The percentage of schools making computers available to parents and community members as well as adult education classes has increased significantly from last year, possibly reflecting increased demand. More than 70% make their computers available to parents/community members and 69% to adult education classes, up from 48% and 40% in the prior year. Ninety-three percent of schools report that they make their computer equipment available to students outside of normal school hours.

Figure 24

Computer Access for After-School Use 1999-2000



Source: Market Data Retrieval, 2000, Public School Findings.

School Type

The number of schools making computers available outside of school hours varies somewhat by school type. Middle/junior high and senior high school students are somewhat more likely (96%) to have access to their schools' computers outside of normal school hours than are elementary school students (91%). Senior high schools are more likely to provide access for adult education classes.

Table 13

Schools Offering Computer Access by School Type[1]

School Type	Students After Hours (%)	Parents/Community (%)	Adult Education Classes (%)
Elementary	91.3	70.7	62.9
Middle/Junior High	96.0	69.3	67.7
Senior High	95.8	71.6	78.7
Combined	96.3	76.6	78.5
Adult/Special/Voc. Ed.	86.2	75.9	87.4
Total	**93.2**	**71.1**	**68.5**

[1] Multiple responses allowed.

Source: Market Data Retrieval, 2000, Public School Findings.

Windows Users – User Profile

☒ Middle/junior high, senior high

☒ Large (more than 1,000)

☒ Rural

☒ Windows 95 dominant version

New PCs purchased by schools now come with Windows 98 as a standard feature. Accordingly, the schools are reporting increased Windows use.

In 1998, 73% of schools owned Windows-capable computers and 69% were Windows users. By 1999, 75% of schools indicated that they owned Windows-capable computers and 72% reported that they were Windows users. In 2000, 81% of schools report that they are Windows users.

State Penetration Levels

As noted, 81% of schools report using Windows. Percentage penetration of Windows users ranges from a high of 98% in West Virginia to a low of 49% in Alaska. (See Table 14 and Figure 25.)

Table 14

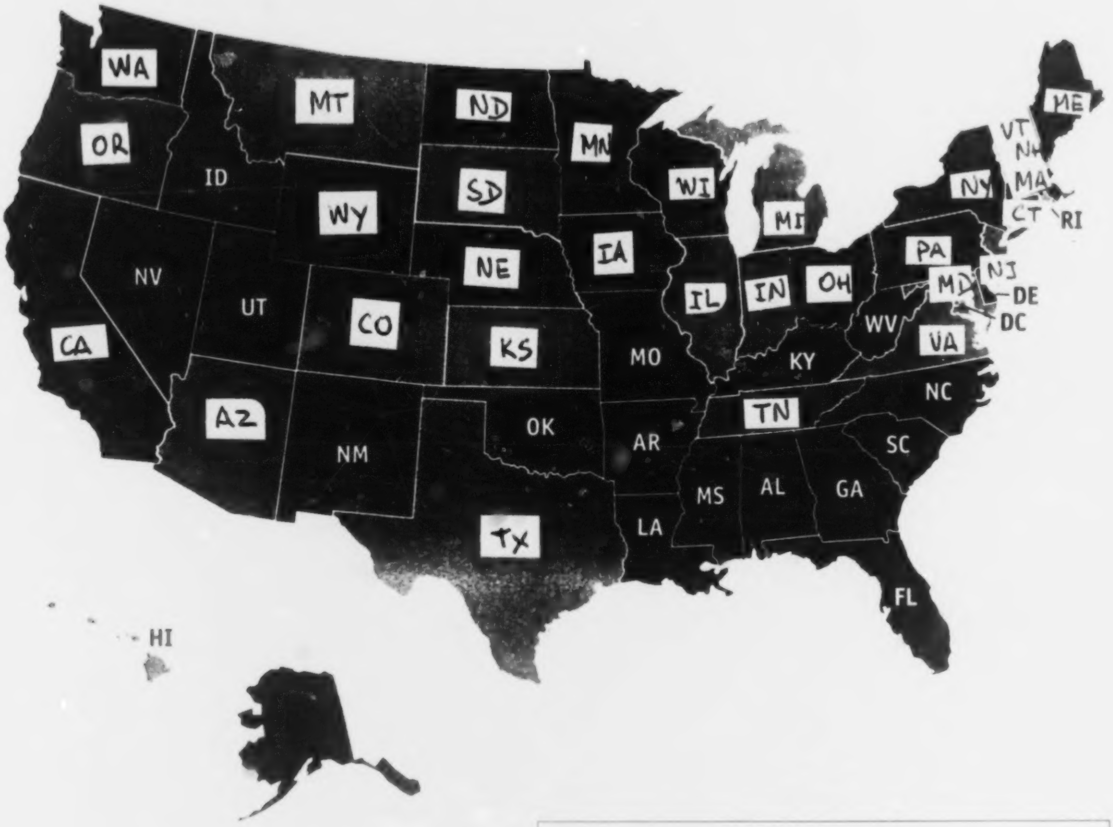
Schools Using Windows

State	School Penetration (%)	
West Virginia	98.2	
South Carolina	97.0	
Alabama	95.1	
Mississippi	94.6	
Idaho	94.5	
Arkansas	94.3	
Kentucky	93.8	
Louisiana	93.2	
Georgia	92.8	
Oklahoma	91.3	
New Mexico	89.5	
North Carolina	89.2	
Utah	89.0	
Delaware	88.1	
Missouri	87.2	
Nevada	86.8	
Florida	85.5	
Texas	85.2	
Virginia	84.2	
Indiana	83.5	
Tennessee	83.3	
Vermont	83.1	
South Dakota	82.4	
Illinois	81.8	
Kansas	81.5	*National Average 81.4%*
Michigan	81.0	
New Hampshire	80.7	
Oregon	80.0	
District of Columbia	79.4	
Arizona	78.3	
Colorado	77.5	
Montana	77.5	
Rhode Island	77.4	
Maryland	76.9	
New Jersey	75.7	
Hawaii	75.6	
Washington	75.4	
New York	75.2	
Wisconsin	74.3	
Pennsylvania	73.1	
Ohio	72.6	
Minnesota	72.5	
Maine	72.2	
Connecticut	71.8	
California	70.9	
North Dakota	70.5	
Massachusetts	67.2	
Nebraska	67.2	
Iowa	65.4	
Wyoming	63.6	
Alaska	49.2	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 25

Schools Using Windows



Percentage of Schools Using Windows

■ Over 85% of Schools

▨ 75%-85% of Schools

■ Under 75% of Schools

2000 National Average: 81% of Schools

BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

School Type vs. School Enrollment

The penetration of Windows users increases with both grade level and enrollment. Thus more senior high schools (95%) use Windows than do middle/junior high schools (87%) or elementary schools (75%). The largest schools, those with 1,000 or more students, report a significantly higher penetration of Windows use than do smaller schools.

Table 15

Windows Users Penetration: School Type by School Enrollment

School Type	All Schools (%)	1-99 (%)	100-199 (%)	200-299 (%)	300-499 (%)	500-999 (%)	1,000-2,499 (%)	2,500+ (%)
Elementary	75.2	72.1	75.5	71.9	74.8	77.2	77.8	100.0
Middle/Junior High	86.8	75.5	82.1	85.8	87.6	87.0	89.4	–
Senior High	94.9	87.4	93.4	95.8	96.6	96.1	96.2	98.3
Combined	92.1	80.4	92.1	95.5	98.5	95.8	100.0	100.0
Adult/Special/Voc. Ed.	86.0	74.7	80.6	92.1	95.0	95.0	93.8	88.9
Total	**81.4**	**77.5**	**80.9**	**78.9**	**79.8**	**82.3**	**91.1**	**95.8**

Source: Market Data Retrieval, 2000, Public School Findings.

School Metro Class

Though metro class exerts some influence on Windows use, school type has a greater influence, as noted in the section above. Rural schools report the highest level of Windows use (86%). Usage levels in the urban schools (77%) and suburban schools (79%) are somewhat lower. It appears that rural schools, with smaller absolute numbers of computers, continue to be better able to keep pace with upgrading their installed base. They also have fewer teachers to train in the process of making the transition to the Windows environment.

Table 16

Windows Users Penetration: School Type by Metro Class

School Type	All Schools (%)	Urban (%)	Suburban (%)	Rural (%)
Elementary	75.2	71.9	72.3	79.6
Middle/Junior High	86.8	84.8	86.6	88.3
Senior High	94.9	93.6	94.6	95.5
Combined	92.1	89.2	90.9	92.5
Adult/Special/Voc. Ed.	86.0	79.4	84.7	94.2
Total	**81.4**	**77.1**	**78.6**	**85.6**

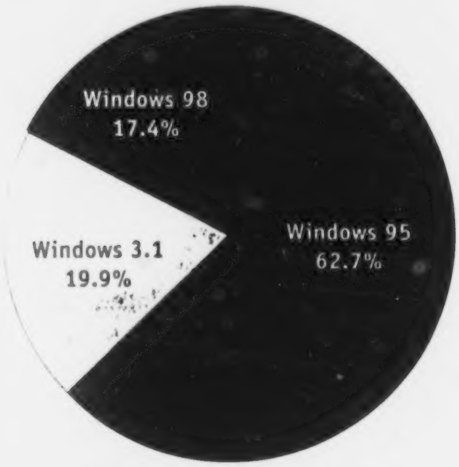
Source: Market Data Retrieval, 2000, Public School Findings.

PCs by Windows Version

Windows 95 remains the dominant version of Windows in the school market, since it runs on 63% of the PC installed base. However, the percentage of computers running Windows 98 more than tripled, increasing from 5% in 1999 to 17% in 2000. Twenty percent of the PC installed base uses Windows 3.1. The significant increases in the percentage of PCs using Windows 98 reflects the number of new computers added to the installed base this year, the majority of which were shipped from the factory with Windows 98 pre-installed.

Figure 26

Computers Using Windows by Version



Source: Market Data Retrieval, 2000, Public School Findings.

Multimedia Computers

A multimedia computer is defined by the presence of a sound card and CD-ROM drive. For the most part, both sound cards and CD-ROM drives are now standard features of the computers that sell to the K-12 market. As a result, 97% of schools report owning at least some multimedia computers. With penetration levels of schools with multimedia so high, the question arises as to what proportion of the installed base is made up of multimedia computers?

State Penetration Levels

Schools report that multimedia computers now make up 58% of the installed base. The percentage of the installed base that is made up of multimedia computers ranges from a high of 73% in Delaware to a low of 46% in Washington.

In New Jersey, Ohio, and Delaware, more than 70% of the installed base is made up of multimedia computers. In contrast, less than 50% of the installed base in North Carolina, Kentucky, the District of Columbia, North Dakota, and Washington is made up of multimedia computers. (See Table 17 and Figure 27.)

Table 17

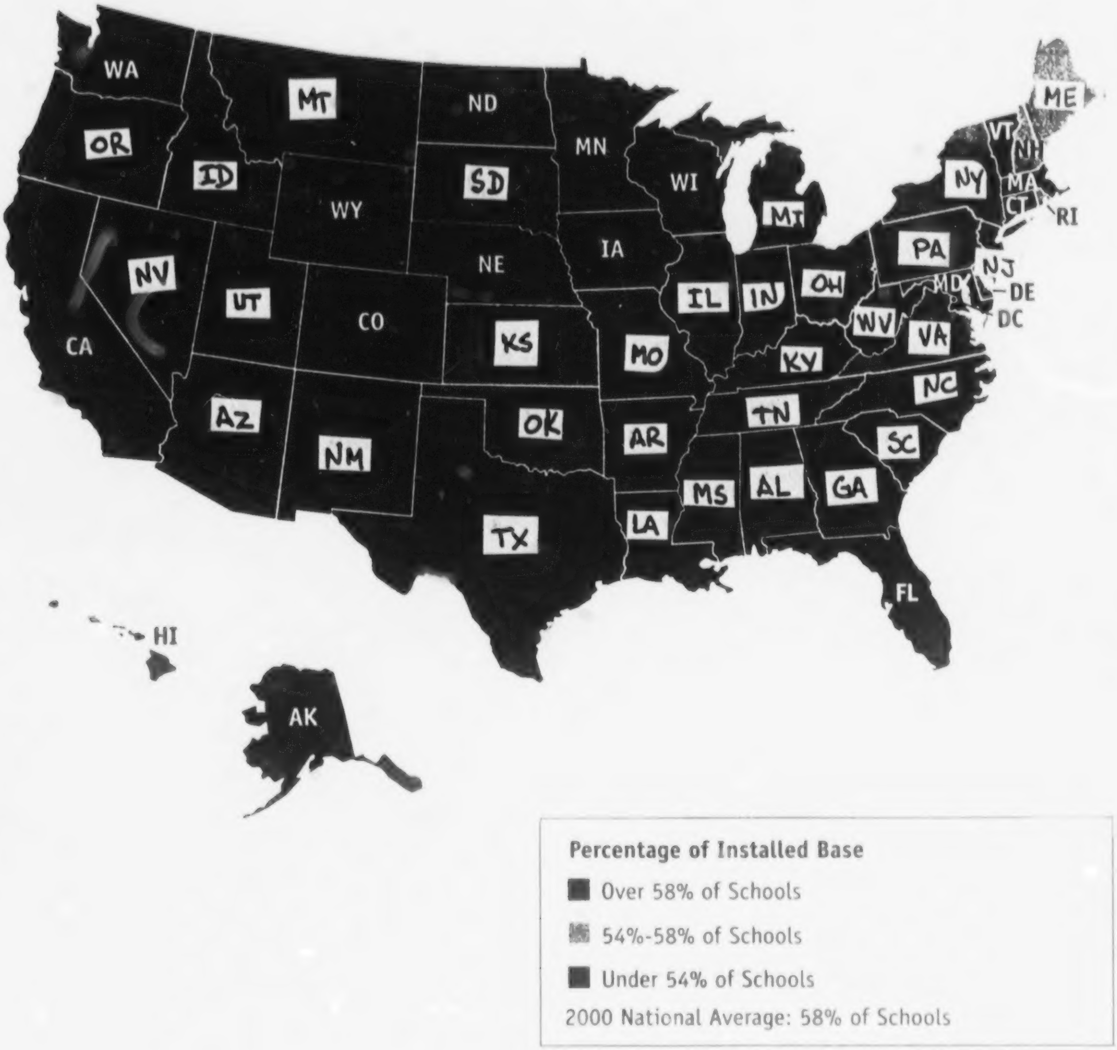
Multimedia Computers: Percentage of Installed Base

State	Installed Base (%)	
Delaware	73.2	
Ohio	72.7	
New Jersey	71.6	
Nevada	66.1	
South Dakota	66.1	
Michigan	65.1	
South Carolina	64.8	
Missouri	63.1	
Louisiana	62.9	
Virginia	62.4	
Pennsylvania	62.3	
Georgia	61.9	
Connecticut	61.3	
Illinois	61.1	
Massachusetts	61.0	
New York	60.8	
Mississippi	60.6	
New Hampshire	60.4	
Texas	59.2	*National Average 58.3%*
Oklahoma	57.6	
New Mexico	57.5	
Tennessee	57.2	
Arkansas	57.2	
Maryland	57.1	
Maine	56.8	
Kansas	56.3	
Minnesota	56.2	
California	56.2	
Oregon	56.1	
Iowa	56.1	
Wisconsin	55.4	
Wyoming	55.4	
Colorado	55.0	
Vermont	54.9	
Idaho	54.8	
Arizona	53.6	
Florida	53.5	
Montana	52.5	
West Virginia	52.5	
Hawaii	52.3	
Indiana	52.2	
Rhode Island	51.9	
Alaska	51.8	
Utah	51.4	
Alabama	51.3	
Nebraska	50.5	
North Carolina	49.2	
Kentucky	49.1	
District of Columbia	46.8	
North Dakota	46.4	
Washington	45.8	

Source: Market Data Retrieval, 2000. Public School Findings.

Figure 27

Multimedia Computers: Percentage of Installed Base



BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

Multimedia Computer Intensity

In 1999-00 the multimedia computer intensity (student-to-multimedia computer ratio) is 7.9 students per multimedia computer compared to 4.9 students per computer for the total installed base of instructional-use computers. This represents a continued improvement over the prior year, when multimedia computer intensity was 9.8 students per multimedia computer.

Multimedia computer intensity is a good illustration of the challenge presented by the ever-escalating pace of technological change. Though schools have now reached what was once a highly prized goal of 5 students per computer, the standard has changed. The 1996 National Technology Plan advocates a goal of 5 students per *multimedia* computer. If the pace of multimedia adoption holds steady, that goal could well be achieved during the current school year. However, the revision of the National Technology Plan, though not complete at this date, is now pointing to the need for universal access for effective information technology at school and at home.

Individual state multimedia intensities range from 4.9 in South Dakota to 11.9 in California. The majority of schools still have some distance to go in providing students access to computers that are capable of handling the latest instructional software, much of which is multimedia intensive and requires high-speed processors and CD-ROM drives. (See Table 18 and Figure 28.)

Table 18

Multimedia Computer Intensity

	State	Students Per Multimedia Computer	
Least Access	California	11.9	
	District of Columbia	11.3	
	Rhode Island	10.7	
	Hawaii	10.6	
	North Carolina	10.5	
	Louisiana	10.3	
	Utah	10.1	
	New Hampshire	10.0	
	Washington	9.9	
	Arizona	9.6	
	Maryland	9.5	
	Mississippi	9.3	
	Oregon	9.3	
	Tennessee	9.0	
	Alabama	8.9	
	Nevada	8.9	
	Arkansas	8.7	
	New Mexico	8.5	
	Massachusetts	8.5	
	Connecticut	8.4	
	New York	8.3	
	Kentucky	8.3	
	Colorado	8.2	
	Maine	8.1	
	Illinois	8.0	
	Vermont	7.9	*National Average 7.9*
	Florida	7.7	
	Michigan	7.7	
	North Dakota	7.6	
	Oklahoma	7.4	
	Minnesota	7.4	
	Georgia	7.4	
	South Carolina	7.3	
	Alaska	7.2	
	Nebraska	7.1	
	Virginia	7.1	
	Pennsylvania	7.1	
	Texas	7.0	
	Idaho	7.0	
	West Virginia	7.0	
	Indiana	6.9	
	Missouri	6.7	
	Iowa	6.7	
	Wisconsin	6.7	
	Montana	6.7	
	New Jersey	6.0	
	Ohio	5.8	
	Delaware	5.8	
	Wyoming	5.8	
	Kansas	5.6	
Greatest Access	South Dakota	4.9	

Source: Market Data Retrieval, 2000, Public School Findings

Figure 28

Multimedia Computer Intensity

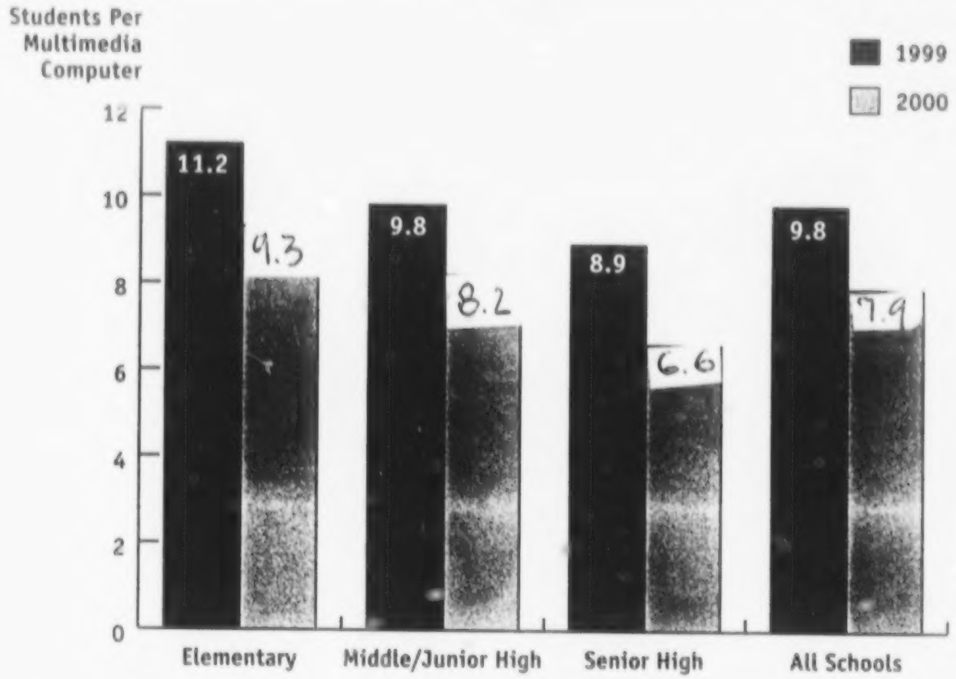
BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

School type has an impact on multimedia computer intensity, roughly the equivalent of its impact on computer intensity for the total installed base. Senior high schools report the most favorable multimedia computer intensity, an average of 6.6 students per multimedia computer. Elementary schools have the least favorable multimedia computer intensity—9.3 students per multimedia computer, with middle/junior high schools reporting 8.2 students per multimedia computer.

Figure 29

Multimedia Computer Intensity by School Type 1999-2000



Source: Market Data Retrieval, 2000, Public School Findings.

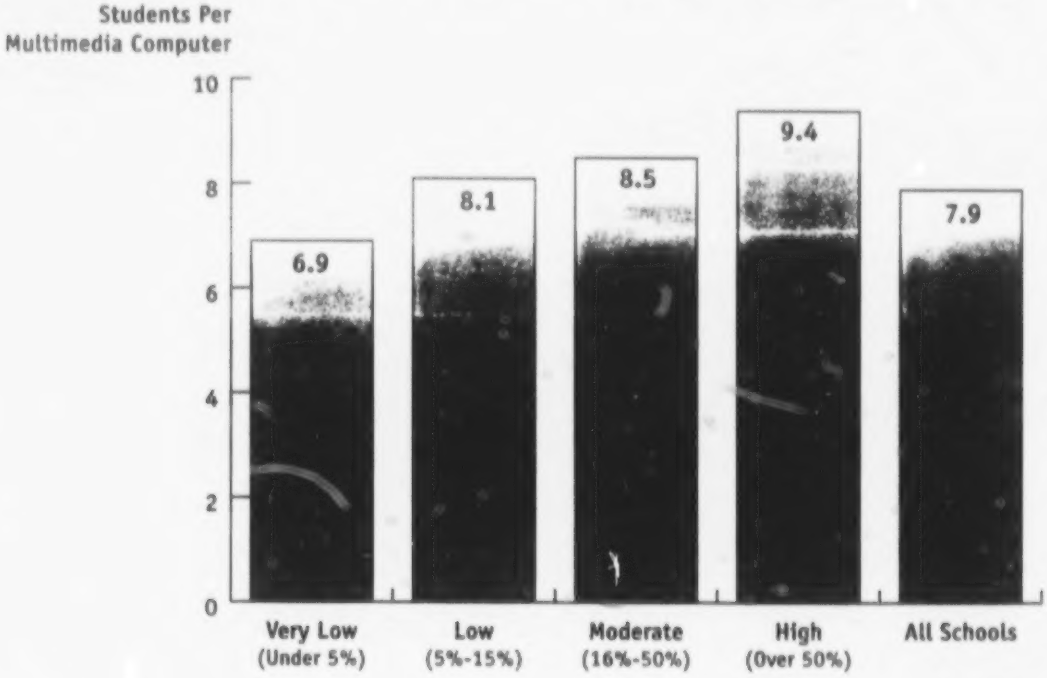
BEST COPY AVAILABLE

Minority Enrollment

Students in schools with high percentages of minority students have more limited access to multimedia computers. Schools with minority enrollments of 50% or more average 9.4 students per multimedia computer compared to 6.9 for schools with fewer than 5% minority enrollments. Thus schools with high percentages of minority students have less favorable multimedia computer intensities than the national average of 7.9. They compare even less favorably to schools with low minority enrollments. While schools have achieved more parity on basic computer access, the digital divide continues to be a problem for access to more sophisticated resources.

Figure 30

Multimedia Computer Intensity by Minority Enrollment



Source: Market Data Retrieval, 2000. Public School Findings.

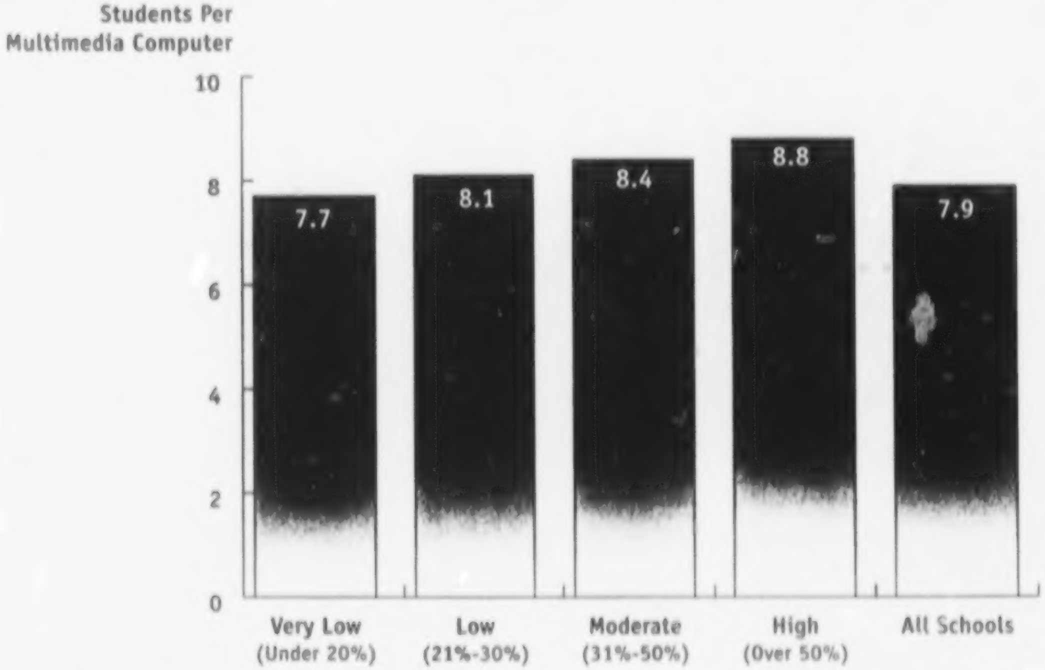
Student Need Indicator

Student need indicator represents the percentage of a public school's enrollment that qualifies for the free lunch program. Updated yearly, qualification for free lunch is based on family size and income criteria. The lower the student need indicator percentage, the better the economic situation in the households of the students attending the school.

Schools with higher percentages of students qualifying for free lunch provide less access to multimedia computers for their students. Schools with high student need (over 50%) average 8.8 students per multimedia computer compared to 7.7 for schools with very low (under 20%) student need.

Figure 31

Multimedia Computer Intensity by Student Need Indicator



Source: Market Data Retrieval, 2000, Public School Findings.

Classrooms With Multimedia Computers

Within schools that have multimedia computers in the classroom, 76% of those classrooms have multimedia computers. Among schools placing multimedia computers in classrooms, elementary schools report the highest percentage of multimedia computer-equipped classrooms, 82%, followed by 72% of classrooms in middle/junior high schools and 68% of classrooms in senior high schools.

Table 19

Classrooms With Multimedia Computers by School Type[1]

School Type	**Classrooms (%)**
Elementary	82.1
Middle/Junior High	72.4
Senior High	68.0
Combined	77.2
Adult/Spec/Voc. Ed.	71.8
Total	**76.2**

[1] Should be read as: Within schools reporting at least one multimedia computer in a classroom, 76.2% of the classrooms have a multimedia computer.

Source: Market Data Retrieval, 2000, Public School Findings.

Multimedia Computer-Intensive Schools

Multimedia computer-intensive schools are those that have a student-to-multimedia computer ratio at or better than the national average of 7.9 students per multimedia computer. In 1999-00 roughly 40% of all public schools are multimedia computer intensive.

Table 20 and Figure 32 present the percentage of schools in each state that are multimedia computer intensive. Sixty percent or more of all schools in South Dakota, Wyoming, and Delaware are multimedia computer intensive, with 7.9 or fewer students per multimedia computer.

At the other end of the multimedia computer intensity scale, only 17% of the schools in Rhode Island and fewer than 25% of the schools in the District of Columbia, Mississippi, Hawaii, and California can be characterized as multimedia computer intensive, with 7.9 or fewer students per computer.

Table 20

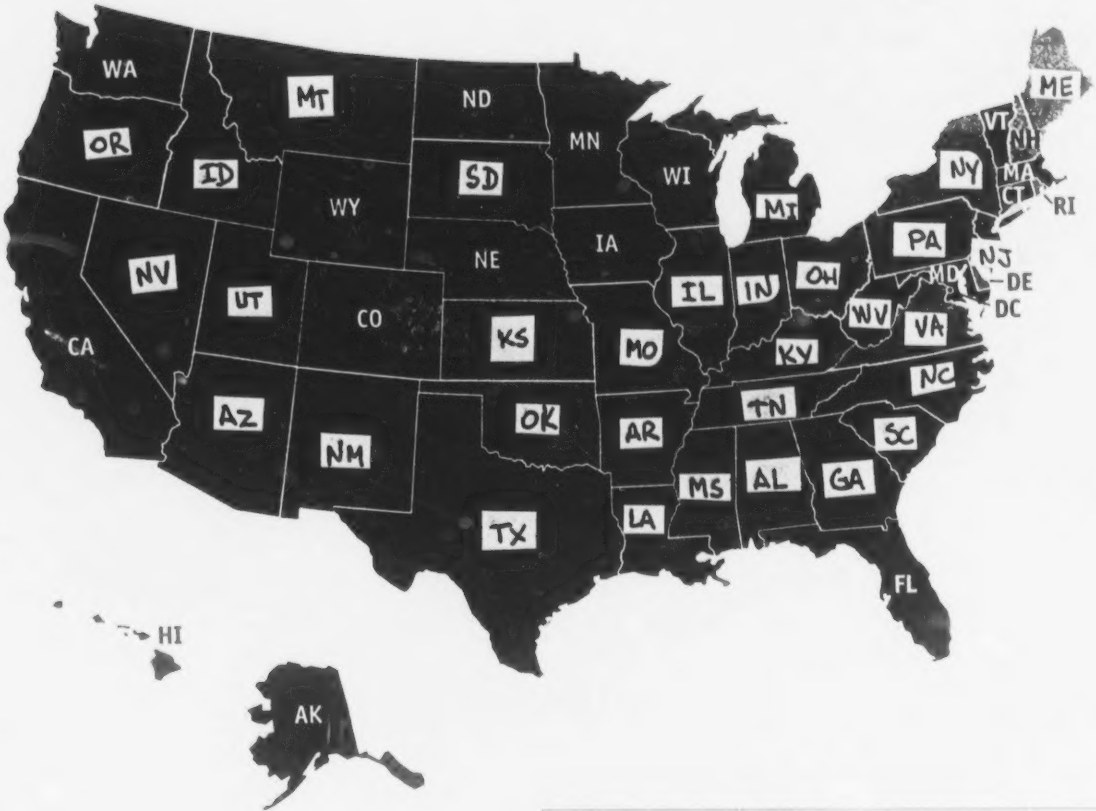
Multimedia-Intensive Schools

State	School Penetration (%)	
Delaware	67.5	
Wyoming	61.1	
South Dakota	60.0	
Nebraska	58.2	
Alaska	58.0	
Ohio	57.4	
Montana	53.6	
Idaho	50.4	
Kansas	50.3	
Wisconsin	48.6	
New Mexico	47.2	
Texas	46.9	
Iowa	46.4	
Minnesota	45.6	
North Dakota	43.9	
Indiana	43.7	
Virginia	43.4	
Missouri	43.0	
South Carolina	42.7	
New Jersey	42.4	
New York	41.0	
Vermont	41.0	
Georgia	40.5	*National Average 39.5%*
Florida	39.4	
Illinois	39.4	
Colorado	39.3	
Oklahoma	39.0	
West Virginia	38.5	
Michigan	38.2	
Nevada	38.1	
Pennsylvania	36.7	
Maine	35.9	
Kentucky	35.7	
Connecticut	34.9	
Oregon	34.6	
Arkansas	33.9	
Washington	33.2	
Tennessee	33.0	
Massachusetts	32.1	
Louisiana	31.8	
Arizona	30.9	
Utah	30.5	
New Hampshire	29.9	
Alabama	29.8	
North Carolina	28.1	
Maryland	26.4	
California	24.1	
Hawaii	21.6	
Mississippi	21.4	
District of Columbia	20.7	
Rhode Island	16.7	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 32

Multimedia-Intensive Schools



Percentage of Schools

■ Over 45% of Schools

▨ 35%-45% of Schools

■ Under 35% of Schools

2000 National Average: 40% of Schools

BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000. Public School Findings.

School Type vs. School Enrollment

The percentage of multimedia-intensive schools increases with grade level but decreases with enrollment. Thus more senior high schools (49%) and middle/junior high schools (38%) are multimedia computer intensive than are elementary schools (31%). Small schools (under 200) are more likely to be multimedia intensive (50% or better) than are their larger (1,000+) counterparts (29% or fewer).

Table 21

Multimedia-Intensive Schools: School Type by School Enrollment

School Type	**All Schools (%)**	**1-99 (%)**	**100-199 (%)**	**200-299 (%)**	**300-499 (%)**	**500-999 (%)**	**1,000-2,499 (%)**	**2,500+ (%)**
Elementary	31.1	50.1	42.5	34.3	30.4	24.3	18.8	-
Middle/Junior High	37.7	67.9	60.7	51.3	43.2	33.0	23.6	-
Senior High	48.8	49.5	65.2	59.2	54.9	47.4	35.4	20.3
Combined	55.6	53.3	64.4	62.2	54.4	44.4	47.1	-
Adult/Special/Voc. Ed.	29.6	54.5	35.4	11.9	11.1	9.1	25.0	-
Total	**36.0**	**51.4**	**49.5**	**40.8**	**35.0**	**29.4**	**29.3**	**19.0**

Source: Market Data Retrieval, 2000, Public School Findings.

Minority Enrollment

Schools with high percentages of minority students are less likely to be multimedia computer intensive. Only 29% of schools with minority enrollments of 51% or more are multimedia computer intensive compared to 43% of schools with fewer than 5% minority enrollments. Minority students are definitely on the less resource-rich side of the digital divide.

Table 22

Multimedia-Intensive Schools:
School Type by Minority Enrollment

School Type	**All Schools (%)**	**0%-4.9% (%)**	**5%-15.9% (%)**	**16%-50% (%)**	**51%+ (%)**
Elementary	31.1	37.9	30.2	29.8	24.7
Middle/Junior High	37.7	43.7	36.4	34.9	31.5
Senior High	48.8	55.3	51.3	44.7	41.6
Combined	55.6	57.9	62.3	60.1	56.7
Adult/Special/Voc. Ed.	29.6	47.6	29.6	54.1	44.3
Total	**36.0**	**43.4**	**35.8**	**34.5**	**29.3**

Source: Market Data Retrieval, 2000, Public School Findings.

Networking

Networking is a broad concept that includes different types of computer-based communications links. Local area networks (LANs) connect the computers in one school to each other and allow access to common data sources, programs, and peripheral devices (such as printers). Wide area networks (WANs) serve larger geographical areas, often linking LANs together. WANs connect the schools' computers to centrally located resources in the district and beyond, including the Internet. Once the network is ubiquitous, schools can move toward a distributed computing model. Distributed computing connects users to information regardless of location or platform. Users have access to a wider variety of resources that they can access using any device, including handheld and wireless units, connected to the network system.

At the building level, LANs give schools an effective way to manage their computer resources. Peripheral and application sharing is facilitated. Network management software makes it easier for teachers to assign students to appropriate levels of work and to monitor basic information about performance, such as time on task. Even more important, however, is the enhanced communication that networking makes possible. Access to a WAN, be it a districtwide network or a statewide backbone network, often provides access to the Internet, thus allowing students and teachers to communicate with people, places, and ideas from around the world.

Greater interconnectivity via WANs and the Internet is allowing administrators to keep track of school and student data using a computing solution that encompasses both informational and instructional management systems. This, in turn, makes it possible to manage and analyze this information effectively and respond appropriately in order to improve the entire education enterprise and boost student learning and achievement.

Wireless technology is becoming an increasingly popular way for schools to establish or extend their LANs. Wireless truly enables anytime, anyplace computing. Unfettered by cable and wires, students can conduct research and communicate with each other wherever they may be, using laptops and other handheld devices. Wireless can be the perfect solution for older buildings, where wires can't be run due to structural problems or asbestos. In a wireless environment, computers are equipped with adapter cards that send and receive radio signals through the air to access points that are plugged into the wired network at a hub or switch. Wireless networks can support data transfer rates of up to 11Mbps. Access points can support between 15 to 25 computers positioned from 500 to 1,000 feet away. Base stations, towers, and antennas can be used to create a wireless WAN with buildings that are a few miles apart, such as the typical college campus. More complex networks can be designed to meet almost any communication needs a school may have. A common application among K-12 schools is to use the wireless network to extend an existing LAN to a new building or to mobile classrooms.

School networks are becoming larger and more complex. New tools from network vendors and software suppliers are making it easier for network administrators at the district level to monitor network connections and keep networks functioning. Enterprise management systems consolidate network management data into a single location and provide users with information on end-to-end performance. Remote monitoring tools make it possible to resolve user problems, such as an inability to print, and to monitor changes to workstation configurations. Administrators can automate tasks such as system updates and application installation. They can also individualize the desktop based on a user's log-in and level of experience. To deal with the increasing complexity, schools are beginning to investigate the possibility of outsourcing their network management and maintenance needs.

Local Area Network (LAN) – User Profile

- Middle/junior high, senior high
- Large (more than 500 students)
- Low to medium poverty levels (less than 16%)
- Favorable student-to-computer ratios (6 or fewer students per computer)

National and State Penetration Levels

LAN penetration continues to grow, though much more slowly, with 87% of schools nationwide reporting that they have a LAN, an increase of only 4% over the year earlier. LAN penetration varies by state, ranging from a high of 100% in Delaware to a low of 70% in Montana. The schools that remain to be networked probably present some of the more difficult challenges, such as asbestos or structural problems that make installing a LAN problematic. Solving these problems will take both time and increased investment. (See Table 23 and Figure 33.)

Table 23

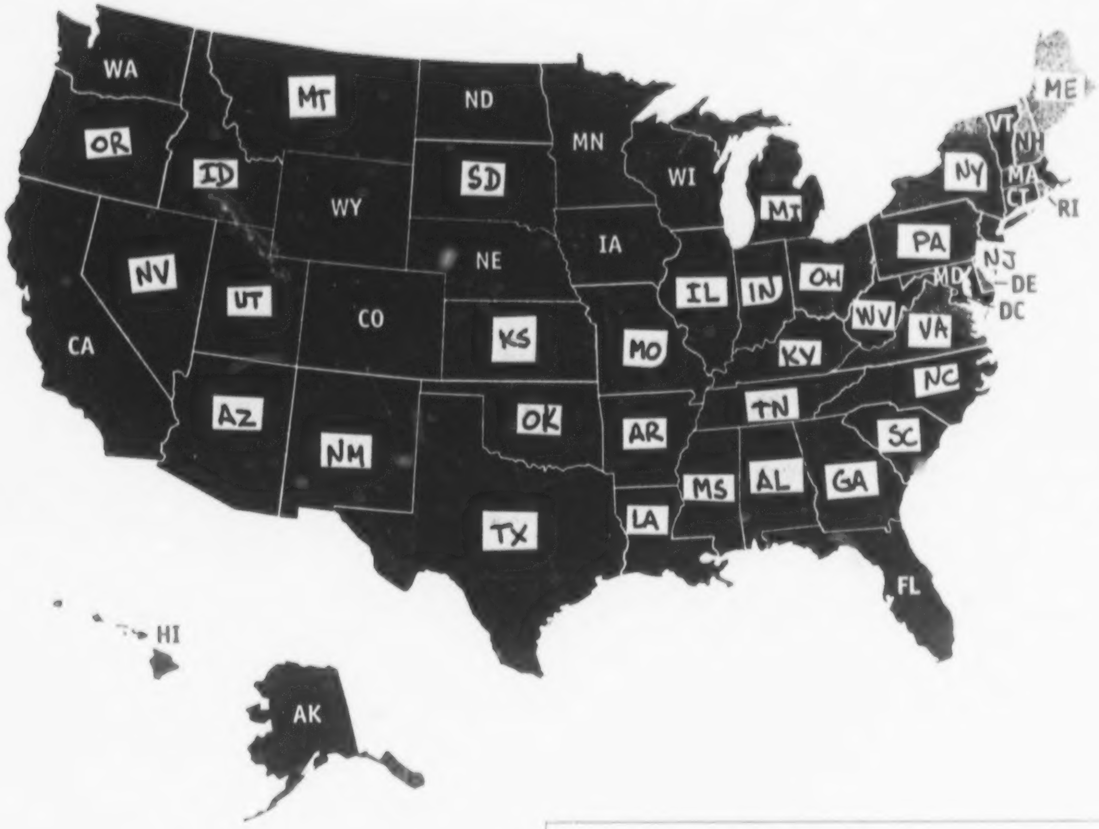
Schools With LANs

State	School Penetration (%)	
Delaware	100.0	
Hawaii	95.6	
Nebraska	95.5	
Wyoming	94.8	
South Carolina	94.4	
Utah	93.4	
Minnesota	92.9	
West Virginia	91.8	
Virginia	91.5	
Wisconsin	91.5	
Georgia	91.4	
Tennessee	91.3	
Alaska	90.8	
Arkansas	90.8	
Colorado	90.8	
Florida	90.7	
Washington	90.6	
Kentucky	90.4	
Missouri	89.6	
Maryland	89.2	
Ohio	89.0	
Iowa	89.0	
Texas	88.8	
Maine	88.0	
Vermont	88.0	
North Carolina	86.8	*National Average 86.8%*
Indiana	86.7	
New Mexico	86.3	
New Hampshire	86.2	
Kansas	86.2	
New Jersey	85.3	
District of Columbia	85.3	
Idaho	84.8	
New York	84.6	
Nevada	84.6	
Pennsylvania	84.4	
Arizona	84.1	
Oregon	84.0	
South Dakota	84.0	
North Dakota	83.8	
Louisiana	83.8	
Connecticut	83.4	
Michigan	82.8	
Illinois	82.6	
California	82.0	
Rhode Island	81.1	
Massachusetts	79.2	
Mississippi	79.2	
Oklahoma	78.9	
Alabama	78.2	
Montana	70.4	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 33

Schools With LANs



Percentage of Schools With LANs

■ Over 90% of Schools

■ 85%-90% of Schools

■ Under 85% of Schools

2000 National Average: 87% of Schools

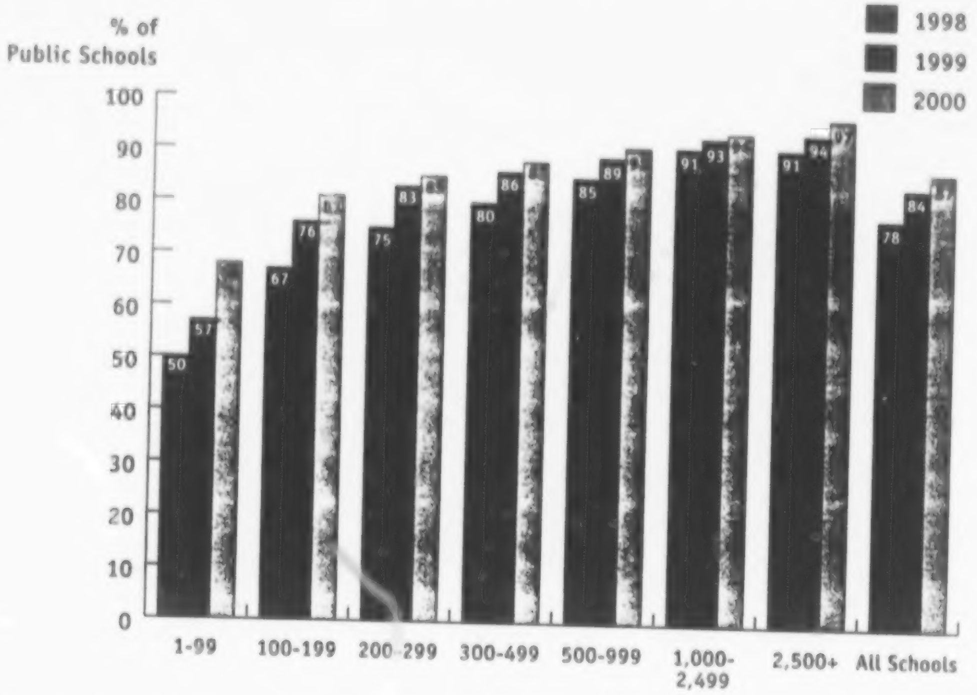
BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

A similar pattern holds for LAN penetration within each of the public school enrollment categories, as can be seen in Figure 34. Only the smallest schools (less than 300) lag behind the national average LAN penetration of 87%. Future growth rates will continue to be higher among these small schools, which still have some way to go to catch up to either the national average or the LAN penetrations of the larger schools.

Figure 34

LAN Penetration by School Enrollment 1998-2000



Source: Market Data Retrieval, 2000, Public School Findings.

School Type vs. School Enrollment

LAN penetration increases with enrollment. Thus the largest schools, those with 1,000 or more students, report a significantly higher LAN penetration than do smaller schools. (See Table 24.) Ninety-four percent or more of the largest schools report having LANs compared to only 68% of schools with enrollments of fewer than 100 students.

Networks help provide the type of efficiency and control over resources that appeal to large schools with significant numbers of computers in place. Thus these schools have tended to take the lead in networking. They also have the internal resources needed to support their network use. Though local area networks, by themselves, have become easier to install and manage, connecting the school's LAN to the outside world is becoming increasingly complex. As schools move away from reliance on dial-up connectivity, a higher degree of technical expertise is required to set up and maintain the network as well as to manage connectivity.

BEST COPY AVAILABLE

School type has a limited impact on percentage of LAN penetration. Middle/junior high schools (92%) and senior high schools (91%) are also somewhat more likely than elementary schools (85%) to be LAN users. Eighty-six percent of combined schools use LANs. The adult/special/voc. ed. schools have the lowest LAN penetration rate, 78%. These schools often are small and may operate in settings other than a traditional school building, in some part explaining why they are less likely to be networked.

Table 24 illustrates the relationship between school type and enrollment size and LAN penetration. LAN use increases with grade level and within each grade level with school size. At least 90% of large (1,000 or more) elementary schools use LANs, a higher penetration rate than that of small (under 100) senior high schools.

Table 24

LAN Penetration: School Type by School Enrollment

School Type	All Schools (%)	1-99 (%)	100-199 (%)	200-299 (%)	300-499 (%)	500-999 (%)	1,000-2,499 (%)	2,500+ (%)
Elementary	85.0	65.3	78.4	82.9	87.2	89.2	89.5	100.0
Middle/Junior High	92.1	81.1	83.6	90.9	90.1	94.4	92.2	100.0
Senior High	90.7	70.6	88.4	90.7	93.2	93.4	96.9	96.6
Combined	85.8	68.7	89.3	89.1	93.7	91.0	94.1	100.0
Adult/Special/Voc. Ed.	78.0	66.7	72.4	77.6	88.1	88.8	87.5	100.0
Total	**86.8**	**67.8**	**81.2**	**85.0**	**88.4**	**90.9**	**94.1**	**97.2**

Source: Market Data Retrieval, 2000, Public School Findings.

Poverty Level

Poverty level indicates the percentage of children below the poverty line in the district. The higher a district's poverty level, the poorer the community it serves.

Fewer schools in districts with higher percentages of poverty report using LANs. While 90% of schools in districts with fewer than 6% poverty-level enrollments use LANs, 83% of schools in districts with 30% or more poverty-level enrollments do so. It would appear that poorer students have less access to networked computers, possibly a reflection of the difficulty of wiring the schools, many of which are older, poorly maintained buildings, some with asbestos or other infrastructure problems.

Table 25

LAN Penetration: School Type by Poverty Level

School Type	All Schools (%)	0%-5.9% (%)	6%-15.9% (%)	16%-29.9% (%)	30%+ (%)
Elementary	85.0	88.2	86.7	83.9	81.6
Middle/Junior High	92.1	94.4	93.6	91.1	88.7
Senior High	90.7	94.2	93.2	89.0	87.6
Combined	85.8	85.7	88.2	85.1	84.1
Adult/Special/Voc. Ed.	78.0	86.2	82.9	72.8	68.6
Total	**86.8**	**90.0**	**88.9**	**85.6**	**83.2**

Source: Market Data Retrieval, 2000, Public School Findings.

Computer Intensity

Schools with favorable computer intensities are more likely to use LANs than are schools with less favorable computer intensity levels. Schools with 6 or fewer students per computer have the highest level of LAN penetration, 89%. On the other hand, only 55% of schools with 30 or more students per computer report LAN penetration. Schools with favorable student-to-computer ratios have a significant number of computers in place and are able to benefit from the efficiencies that LANs offer. Schools at the other end of the spectrum are faced with a significant investment just to improve their student-to-computer ratios and have not focused on network investments as yet.

Table 26

LAN Penetration: School Type by Computer Intensity

School Type	All Schools (%)	1-3 (%)	4-6 (%)	7-9 (%)	10-14 (%)	15-19 (%)	20-29 (%)	30+ (%)
Elementary	85.0	89.4	87.9	83.8	80.7	70.5	64.8	53.0
Middle/Junior High	92.1	92.4	94.4	90.5	90.6	88.9	74.3	57.9
Senior High	90.7	91.4	92.1	90.2	84.1	87.0	71.9	70.6
Combined	85.8	87.0	88.0	87.1	72.7	44.4	50.0	50.0
Adult/Special/Voc. Ed.	78.0	84.1	72.9	77.4	81.3	71.4	67.6	54.5
Total	**86.8**	**89.9**	**89.3**	**85.5**	**82.3**	**73.7**	**66.4**	**55.3**

Source: Market Data Retrieval, 2000, *Public School Findings.*

Networked Computer Intensity

LANs connect students to each other and to centralized resources. Students with access to networked computers can communicate with teachers, work together on projects, and share data and scarce resources, thereby enjoying a richer learning experience. They also have easy access to the Internet. Networked computer intensity—the ratio of students to networked computers—is 6.4 in 2000.

Networked computer intensity varies by state, ranging from a very favorable 3.7 in South Dakota to a much less favorable 12.8 in the District of Columbia. As was true for computer intensity, states with small student populations, such as Wyoming and South Dakota, are able to provide high student-to-computer ratios for relatively modest investments, while large population states, such as California, are challenged to improve their intensities by even 1 student. (See Table 27 and Figure 35.)

Table 27

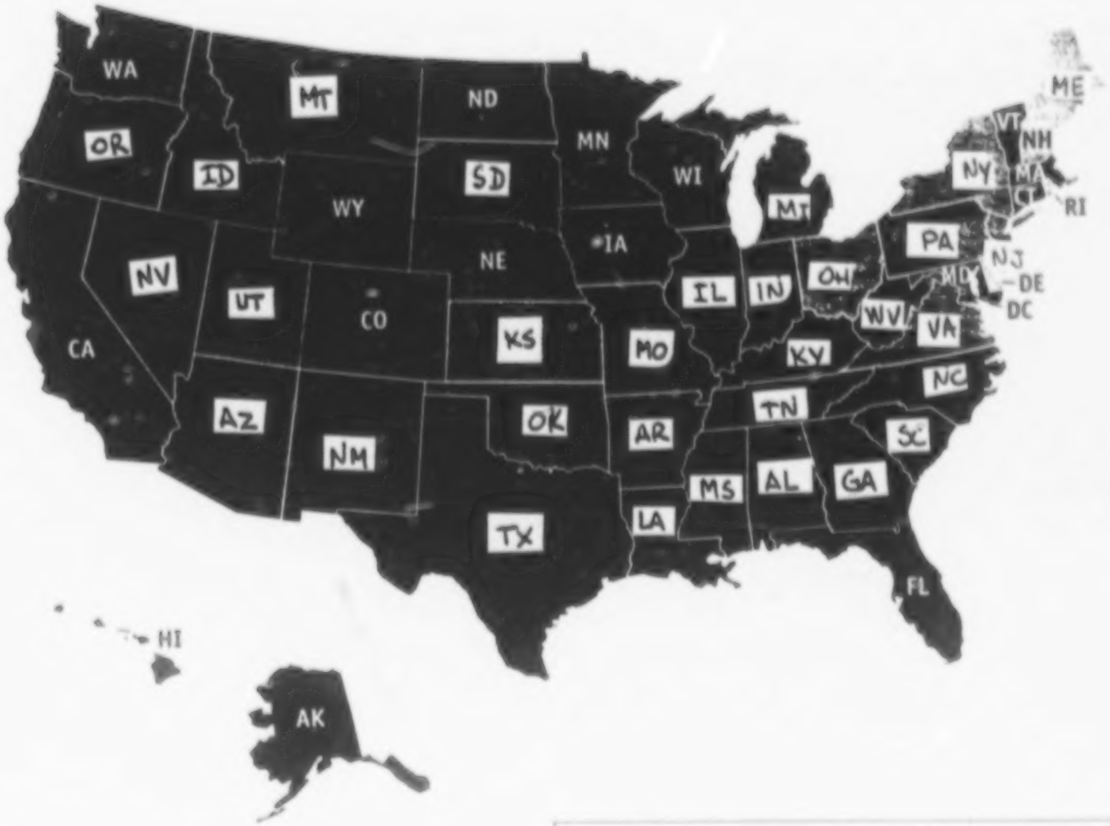
Networked Computer Intensity

	State	Students Per Networked Computer	
Least Access	District of Columbia	12.8	
	California	10.8	
	Louisiana	10.8	
	Nevada	9.1	
	Mississippi	9.0	
	North Carolina	8.5	
	New Hampshire	8.4	
	Maryland	8.4	
	Hawaii	8.1	
	Alabama	7.8	
	Rhode Island	7.8	
	Tennessee	7.8	
	Connecticut	7.6	
	New York	7.2	
	Arkansas	6.8	
	Arizona	6.8	
	Massachusetts	6.8	
	New Mexico	6.7	
	Colorado	6.7	
	Oregon	6.7	
	Utah	6.6	
	South Carolina	6.5	
	Michigan	6.5	
	Georgia	6.5	
	Pennsylvania	6.4	*National Average 6.4*
	Virginia	6.3	
	Washington	6.2	
	Florida	6.2	
	Illinois	6.2	
	Texas	6.1	
	Maine	6.0	
	Oklahoma	5.9	
	Missouri	5.6	
	New Jersey	5.5	
	Minnesota	5.3	
	Delaware	5.3	
	West Virginia	5.3	
	Kentucky	5.3	
	Vermont	5.2	
	North Dakota	5.1	
	Ohio	5.1	
	Montana	5.0	
	Iowa	5.0	
	Alaska	4.9	
	Idaho	4.9	
	Indiana	4.8	
	Nebraska	4.7	
	Wisconsin	4.3	
	Wyoming	4.2	
	Kansas	4.0	
Greatest Access	South Dakota	3.7	

Source: Market Data Retrieval, 2000, Public School Findings

Figure 35

Networked Computer Intensity



Students Per Networked Computer

■ Under 5.3 Students

▨ 5.3-6.4 Students

■ Over 6.4 Students

2000 National Average: 6.4 Students

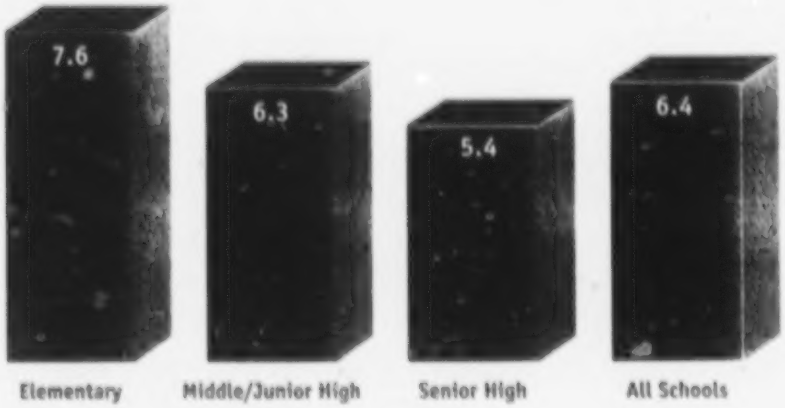
Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

When networked computer intensity is considered, senior high schools fare best, with a networked computer intensity of 5.4 students. Senior high schools have higher numbers of computers and more of them are networked, giving high school students the best access to networked computers. Elementary schools have an average of 7.6 students per networked computer, and middle/junior high schools have 6.3 students for each networked computer.

Figure 36

Network Computer Intensity by School Type
(Students Per Networked Computer)



Source: Market Data Retrieval, 2000, Cyber School Findings

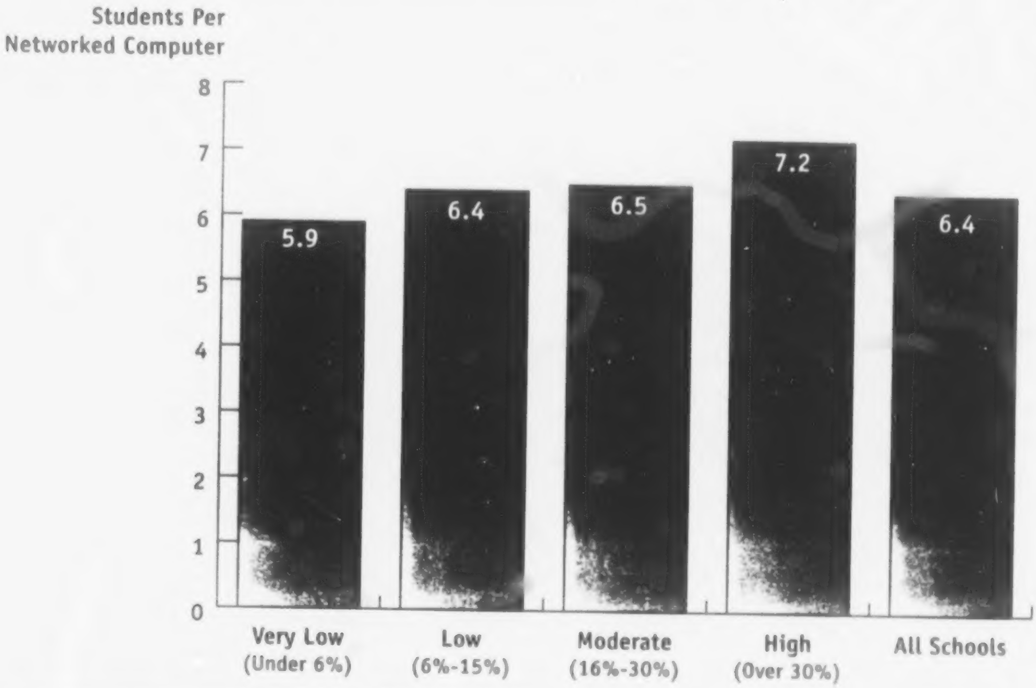
Networked Computer Intensity by Poverty Level

Poverty level indicates the percentage of children below the poverty line in the district. The higher a district's poverty level, the poorer the community it serves.

Students in schools with high percentages of poverty have more limited access to networked computers. Schools with over 30% poverty-level enrollments average 7.2 students per networked computer compared to 5.9 for schools with fewer than 6% poverty-level enrollments.

Figure 37

Networked Computer Intensity by Poverty Level



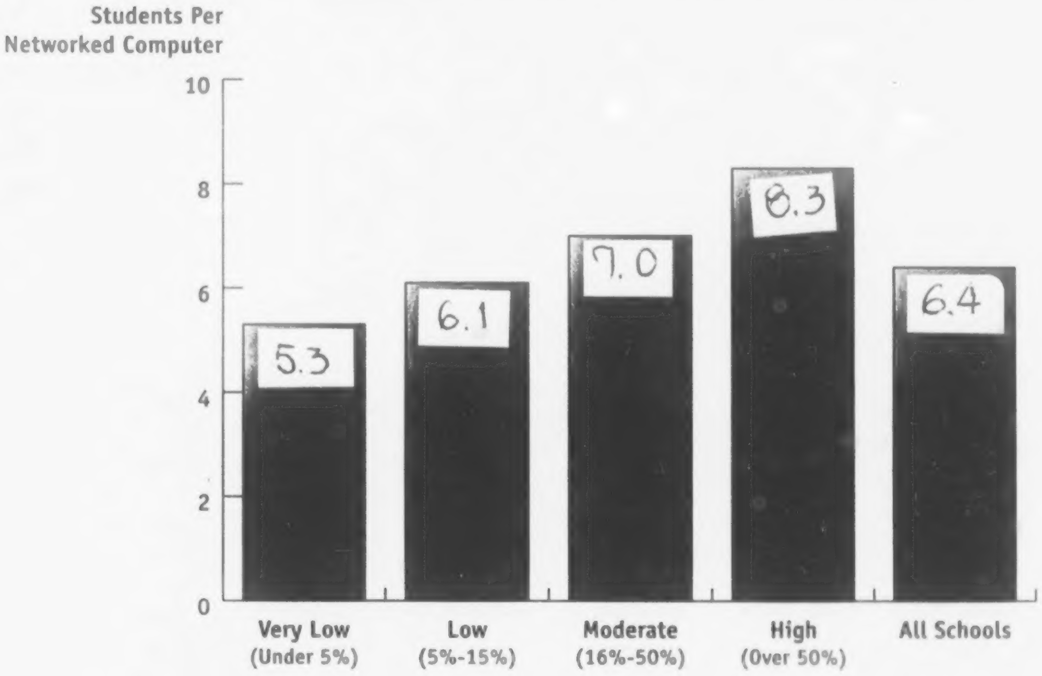
Source: Market Data Retrieval, 2000, Public School Findings.

Networked Computer Intensity by Minority Enrollment

Students in schools with high percentages of minority students have even more limited access to networked computers. Schools with over 50% minority enrollments average 8.3 students per networked computer compared to 5.3 for schools with fewer than 5% minority enrollments. Thus schools with high percentages of minority students have less favorable networked computer intensities than the national average of 6.4. They compare even less favorably to schools with low minority enrollments. Three additional students share every networked computer in schools with high minority enrollments as compared to schools with low minority enrollments.

Figure 38

Networked Computer Intensity by Minority Enrollment



Source: Market Data Retrieval, 2000, Public School Findings.

Quantity of Computers on LANs

Fifty-three percent of schools report that their networks currently connect 50 or more computers. Twenty-eight percent indicate that they have from 20 to 49 computers on their LANs and 19% have from 1 to 19 computers.

Senior high schools are most likely to report networking a significant number of computers, followed closely by middle/junior high schools. Elementary schools, on the other hand, are more likely to have relatively few computers on their LANs. Seventy-one percent of senior high schools indicate that their LANs connect 50 or more computers. Only 44% of elementary schools report connecting this many computers. While only 10% of middle/junior high schools and 13% of senior high schools have between 1 to 19 computers on their LANs, 23% of elementary schools fall in this category. These findings are not surprising considering that senior high schools tend to have higher enrollments and more computers.

Table 28

Quantity of Computers on LANs by School Type[1]

School Type	1-19 (%)	20-49 (%)	50+ (%)
Elementary	22.9	32.7	44.4
Middle/Junior High	9.5	21.6	68.9
Senior High	12.7	16.6	70.6
Combined	21.0	28.7	50.3
Adult/Special/Voc. Ed.	35.8	27.7	36.5
Total	**19.3**	**27.8**	**52.9**

[1] Based on respondents who indicated computer quantity on LANs.

Source: Market Data Retrieval, 2000, Public School Findings.

Classrooms With Networks

Within schools who have their classrooms connected to a LAN, 84% of the classrooms are connected to the LAN. Among schools connecting classrooms to a LAN, elementary schools report the highest percentage of LAN-connected classrooms, 86%, followed by 83% of classrooms in middle/junior high schools and 81% of classrooms in senior high schools.

Table 29

Networked Classrooms by School Type[1]

School Type	Networked Classrooms (%)
Elementary	86.2
Middle/Junior High	83.0
Senior High	81.1
Combined	88.7
Adult/Spec/Voc. Ed.	78.9
Total	84.1

[1] Should be read as: Within schools reporting at least one networked computer in a classroom, 84.1% of the classrooms are networked.

Source: Market Data Retrieval, 2000, Public School Findings.

Types of Network Systems Used

Novell continues to be the most widely used brand of networking system among schools, with 53% of schools using a Novell networking system. Only 27% of schools use an AppleShare network, down slightly from 28% the year earlier. The penetration of Windows NT networks is increasing, growing from 24% of schools reporting their use in 1999 to 32% in 2000. Other networking systems, including UNIX, are reported by 6% of schools.

The brands of LAN in use vary by school type. Over 40% of senior high schools use Windows NT networks, while only 27% of elementary schools do. Conversely, one in three (32%) of elementary schools use AppleShare networks, while only 18% of senior high schools are AppleShare users.

Table 30

Network System by School Type[1]

School Type	Novell (%)	Windows NT (%)	AppleShare (%)	UNIX (%)	Other (%)
Elementary	49.8	26.8	31.9	1.7	4.0
Middle/Junior High	56.2	32.4	26.2	2.0	2.7
Senior High	60.1	40.8	17.5	2.5	2.5
Combined	47.7	45.2	17.5	1.9	3.3
Adult/Special/Voc. Ed.	57.7	42.0	15.5	3.3	6.4
Total	**52.8**	**31.6**	**27.2**	**2.0**	**3.5**

[1] Multiple responses allowed.

Source: Market Data Retrieval, 2000, Public School Findings.

Wide Area Networks

☒ Large schools (more than 1,000 students)

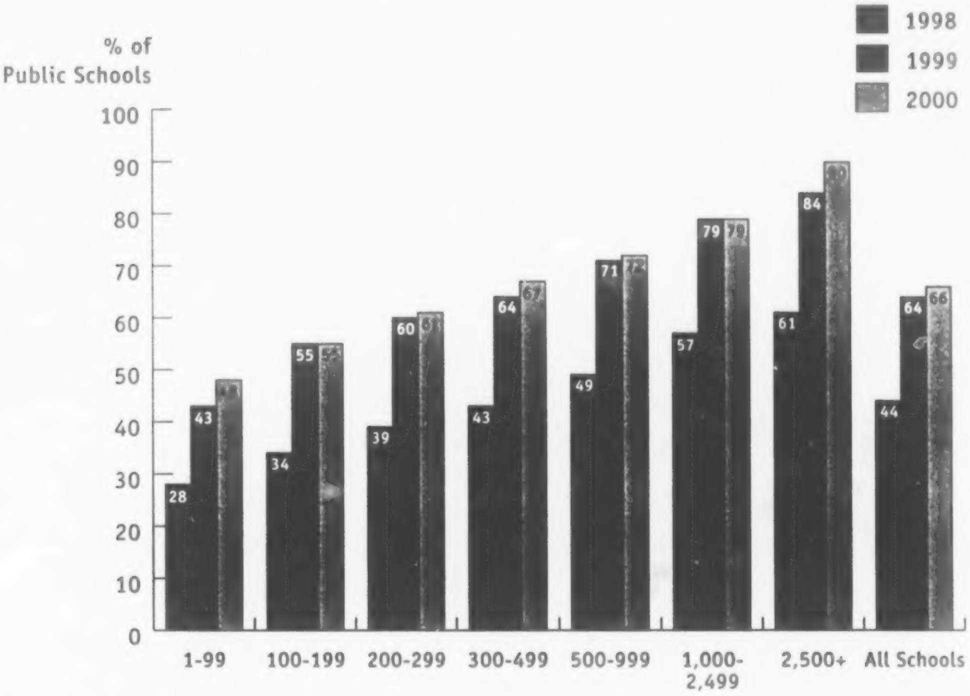
☒ Urban

National and State Penetration Levels

Not surprisingly for a technology that often offers schools a gateway to the Internet, WAN penetration has been growing rapidly. WAN penetration grew from 44% in 1998 to 64% in 1999. Growth appears to have slowed, at least for the time being, with 66% of schools reporting the presence of a WAN. A similar pattern holds for WAN penetration within each of the public school enrollment categories, as can be seen in Figure 39. Growth rates slowed even among the smaller schools, which still have a way to go to catch up to the national average.

Figure 39

WAN Penetration by School Enrollment 1998-2000



Source: Market Data Retrieval, 2000. Public School Findings

WAN penetration varies by state, ranging from a high of 95% in Delaware to a low of 37% in Montana. State penetrations above 75% are still quite unusual. They are typically the result of a statewide initiative, focused on connecting all the schools in the state and providing a gateway to the Internet. Such initiatives include Delaware's effort to wire every classroom in every school in the state, Hawaii's effort to connect every school LAN to the statewide network, and Utah's statewide initiative called UtahNet. Arkansas provides Internet access via a statewide backbone, as does South Carolina. The Florida Instructional Resource Network (FIRN) is one of the oldest statewide networks, and Kentucky and West Virginia also operate well-established statewide technology programs. (See Table 31 and Figure 40.)

BEST COPY AVAILABLE

Table 31

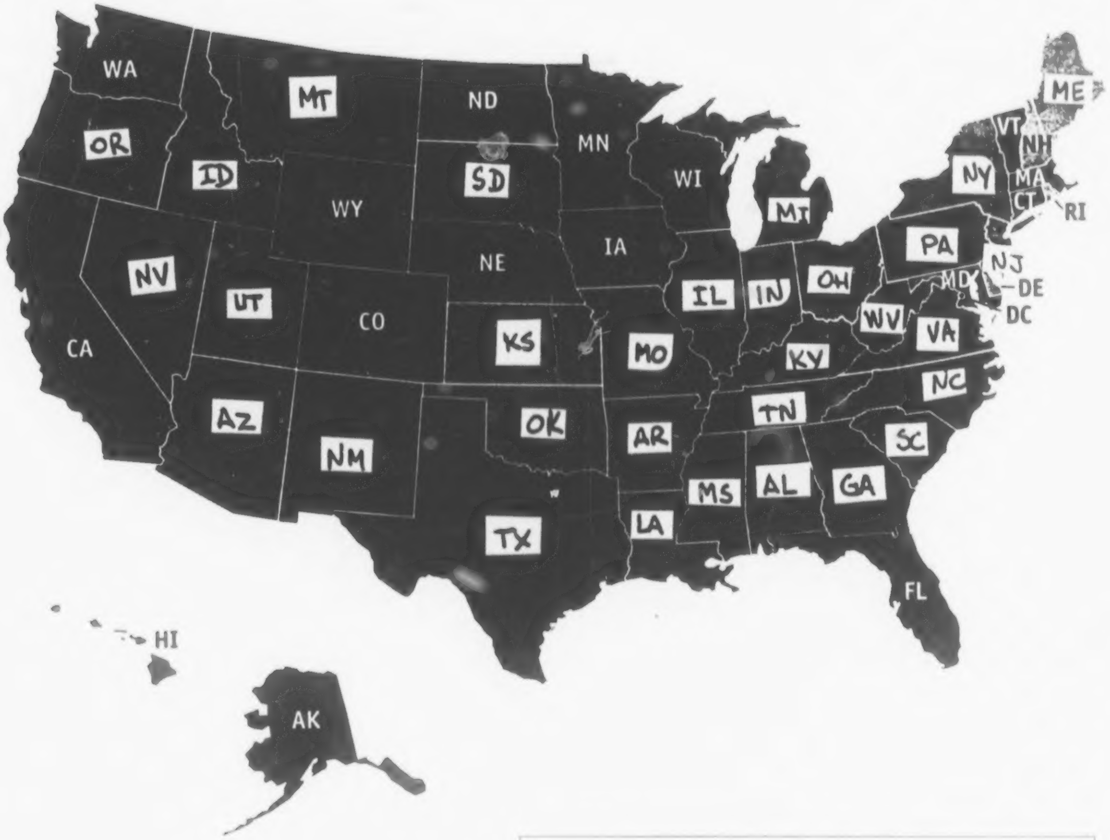
Schools With WANs

State	School Penetration (%)	
Delaware	95.2	
Hawaii	91.1	
Utah	88.5	
South Carolina	85.8	
Kentucky	81.9	
Washington	81.7	
Arkansas	81.6	
Florida	79.8	
West Virginia	78.6	
Nevada	75.8	
Wyoming	75.3	
Tennessee	74.4	
Minnesota	73.9	
Colorado	73.8	
Oregon	73.5	
Alaska	73.3	
Nebraska	72.6	
Ohio	71.9	
Texas	71.5	
California	70.2	
Iowa	68.3	
Virginia	68.0	
Arizona	67.8	
Missouri	67.8	
Maine	67.7	
Maryland	66.9	
Wisconsin	66.9	
Georgia	66.5	*National Average 66.3%*
Rhode Island	66.0	
District of Columbia	64.7	
Idaho	64.1	
New Mexico	64.1	
Mississippi	62.2	
Pennsylvania	61.8	
Louisiana	61.5	
North Carolina	59.5	
Michigan	58.8	
Illinois	58.0	
New York	56.7	
South Dakota	56.5	
North Dakota	55.2	
Indiana	54.8	
New Jersey	54.3	
Connecticut	53.4	
Vermont	53.0	
Kansas	52.5	
Massachusetts	52.3	
Alabama	46.3	
Oklahoma	46.3	
New Hampshire	44.0	
Montana	36.7	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 40

Schools With WANs



Percentage of Schools With WANs

- ■ Over 70% of Schools
- ▨ 60%-70% of Schools
- ■ Under 60% of Schools

2000 National Average: 66% of Schools

BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

School Type vs. School Enrollment

As was true for LANs, school size also has a strong effect on WAN penetration, with WAN use rising steadily as enrollment increases. Roughly 80% or more of the largest schools (1,000 or more students) use WANs compared to only 48% of the smallest schools (under 100 students).

School type has less of an impact on percentage of WAN penetration than it does on many of the other technologies examined. Though middle/junior high schools (72%) and senior high schools (70%) report the highest percentage penetration for WANs, elementary schools do not lag too badly at 65%. It would seem that WAN access is being rolled out to all types of schools in roughly equal proportions. Fifty-six percent of combined schools and 58% of adult/special/voc. ed. schools have access to a WAN.

Table 32 illustrates the relationship between school type and enrollment size and WAN penetration. WAN use increases somewhat with grade level and within each grade level with school size. At least 76% of large (1,000 or more) elementary schools use WANs, a higher penetration rate than that of all senior high schools except the largest.

Table 32

WAN Penetration: School Type by School Enrollment

School Type	All Schools (%)	1-99 (%)	100-199 (%)	200-299 (%)	300-499 (%)	500-999 (%)	1,000-2,499 (%)	2,500+ (%)
Elementary	65.2	45.4	52.7	59.8	67.4	72.0	75.6	100.0
Middle/Junior High	72.0	58.5	52.1	68.5	66.9	75.8	78.2	100.0
Senior High	70.0	53.4	60.0	64.9	70.3	71.9	81.8	89.8
Combined	56.3	45.8	62.4	62.8	56.3	55.6	70.6	100.0
Adult/Special/Voc. Ed.	58.2	50.0	56.1	55.3	62.4	71.3	59.4	88.9
Total	**66.3**	**48.4**	**55.0**	**61.4**	**67.1**	**72.4**	**79.1**	**90.1**

Source: Market Data Retrieval, 2000, Public School Findings.

Metro Class

Metro class has a limited impact on WAN use. Urban schools (70%) and suburban schools (70%) are most likely to use WANs. Sixty-two percent of rural schools use WANs. It is easier to deploy a WAN in the more confined areas associated with urban and most suburban districts. Rural areas have been the last to see WAN expansion except in those states where rural services have been a priority of the governor or legislature, such as Iowa, Texas, and Nebraska.

Table 33

WAN Penetration: School Type by Metro Class

School Type	All Schools (%)	Urban (%)	Suburban (%)	Rural (%)
Elementary	65.2	69.6	68.4	59.4
Middle/Junior High	72.0	76.0	72.9	68.6
Senior High	70.0	72.7	73.0	67.5
Combined	56.3	56.8	58.4	56.2
Adult/Special/Voc. Ed.	58.2	57.8	61.3	57.1
Total	**66.3**	**70.2**	**69.5**	**62.0**

Source: Market Data Retrieval, 2000, Public School Findings.

Percentage of Classrooms Networked

Not surprisingly, WAN penetration is highest among schools with the highest percentage of classrooms connected to a LAN. These schools are well situated to take advantage of the gateway to the Internet or district intranet that WANs enable. WAN penetration increases as the percentage of classrooms connected to the network increases. While 67% of schools with less than 10% of their classrooms on the network use WANs, 79% of schools with 50% or more of their classrooms connected to the network do so.

Table 34

WAN Penetration:
School Type by Percentage of Classroom's Networked

School Type	All Schools (%)	1%-9% (%)	10%-29% (%)	30%-49% (%)	50%+ (%)
Elementary	65.2	68.3	70.3	76.4	78.7
Middle/Junior High	72.0	65.8	76.7	76.3	81.4
Senior High	70.0	65.5	71.4	75.0	80.1
Combined	56.3	50.0	63.3	68.8	67.8
Adult/Special/Voc. Ed.	58.2	65.0	65.9	88.9	77.0
Total	**66.3**	**66.6**	**71.1**	**76.3**	**78.7**

Source: Market Data Retrieval, 2000, Public School Findings.

Computer Intensity

Schools with favorable computer intensities are more likely to use WANs than are schools with less favorable computer intensity levels. Schools with 30 or more students per computer have the lowest level of WAN use (44%). On the other hand, 68% of schools with the most favorable student-to-computer ratios (6 or fewer students per computer) use WANs.

Table 35

WAN Penetration: School Type by Computer Intensity

School Type	All Schools (%)	1-3 (%)	4-6 (%)	7-9 (%)	10-14 (%)	15-19 (%)	20-29 (%)	30+ (%)
Elementary	65.2	67.6	67.2	64.4	63.0	56.0	51.3	44.3
Middle/Junior High	72.0	73.3	73.8	70.4	68.4	69.8	60.0	47.4
Senior High	70.0	69.9	72.3	71.1	65.1	53.7	56.3	41.2
Combined	56.3	58.1	57.5	51.4	39.4	33.3	50.0	50.0
Adult/Special/Voc. Ed.	58.2	62.9	56.4	58.1	52.1	50.0	55.9	40.9
Total	**66.3**	**67.8**	**68.4**	**65.6**	**63.2**	**56.8**	**53.0**	**44.1**

Source: Market Data Retrieval, 2000, Public School Findings.

Metro Class by Poverty Level

Poor students have less access to a wide area network. This is especially true for poor students in urban and suburban schools. Only 63% of urban schools with 30% or higher poverty-level enrollments use WANs compared to 75% of urban schools with fewer than 6% poverty-level enrollments. The same pattern holds true among suburban schools, where WAN penetration is at 59% for the poorest schools compared to 70% for schools with fewer than 6% poverty-level enrollments.

Table 36

WAN Penetration: Metro Status by Poverty Level

Metro Status	All Schools (%)	0%-5.9% (%)	6%-15.9% (%)	16%-29.9% (%)	30%+ (%)
Urban	70.2	74.9	75.7	70.5	63.4
Suburban	69.5	70.3	70.3	69.0	59.1
Rural	62.0	57.5	63.0	61.8	62.7
Total	**66.3**	**68.2**	**68.3**	**65.6**	**62.6**

Source: Market Data Retrieval, 2000, Public School Findings.

Internet Access

The speed at which the schools have accepted the Internet has been truly remarkable. Over the past three years the percentage of schools with Internet access has tripled. Even before the influx of E-rate money, most schools had some degree of Internet access. Traditionally, school connectivity has been aided by large investments from the states and a significant amount of local effort and investment. As schools continue to implement the programs for which they received approval as part of their E-rate application, Internet access and individual classroom connectivity can be expected to increase even more sharply.

The Telecommunications Act of 1996 charged the Federal Communications Commission with developing a universal service policy that would bring affordable access to the Internet, distance learning, and other telecommunications-based learning technologies to America's school children and library users. The resulting E-rate is a federally-managed program that provides significant discounts on telecommunications technologies to schools and libraries in the United States. Discounts range from 20% to 90% and are based on the percentage of students participating in the federal school lunch program who are served by the school or library, with the poorest schools and libraries receiving the deepest discounts. The discounts apply to Internet, telecommunications, and internal connection services for both schools and public libraries. The E-rate is administered by the Universal Service Administrative Company (USAC), a private, not-for-profit corporation that is responsible for ensuring universal service to telecommunications services throughout the country. USAC's Schools and Libraries Division (SLD) is specifically responsible for providing telecommunications discounts to America's schools and libraries.

The E-rate program may be funded up to a cap of $2.25 billion annually. In Program Year One, the FCC authorized $1.925 billion, and in Year Two, the FCC authorized $2.25 billion.

The Schools and Libraries Division (SLD) approved $3.66 billion in discounts through the end of Program Year Two. These discounts were distributed to more than 56,000 applicants, including 9,682 libraries. Some money has been held in reserve to deal with funding appeals and other special circumstances. The bulk of the funding, 59%, went to support costs associated with internal connections. Telecommunications services accounted for 34% of funding and Internet access for 7%. Urban school and libraries received 68% of funds, rural entities received 27% of total funding, and 5% went to unclassified entities.

The SLD received more than 36,000 applications from schools and libraries across the country requesting approximately $4.72 billion in E-rate discounts for Program Year Three (July 1, 2000 - June 30, 2001). Through September 15, 2000, $1.57 billion has been committed to fund Year Three applications. The funding cap of $2.25 billion remains in place for Year Three. As a result, all approved requests for priority one services—telecommunications and Internet access services—received during the filing window will be funded. The SLD has determined that funds are sufficient to provide for all internal connection requests at the 90% discount level, but given total demand greater than $4.7 billion, funds are insufficient to support internal connection requests below the 81% discount level. For levels at 81% to 89%, funding is uncertain.

After a relatively quiet period, public debate over the E-rate has once again picked up. As part of the appropriation process, three separate amendments that would impose Internet filtering requirements and/or the implementation of an Acceptable Use Policy (AUP) for all schools and libraries that receive E-rate subsidies have been introduced. There is no way to judge the fate of these efforts as the process moves through Congress.

Detailed information on the E-rate program can be found at the Schools and Libraries Division's Web site, *http://www.sl.universalservice.org* and the Funds For Learning site, *http://www.fundsforlearning.com.*

The schools appear to have settled into the routine of planning and applying for E-rate discounts to support their telecommunications programs. But applying for funding and setting up contracts for telecommunications services is just the first step. The schools need to develop meaningful ways to use the Internet to support instruction. As the World Wide Web expands exponentially and new Web-based applications and technologies proliferate, schools are faced with the challenge of sorting through the available resources to identify those that align with their instructional goals. Once thought of as a giant reference library, the Internet has expanded to offer not only digital content but also assessment services, tutoring, distance learning, videoconferencing, data warehousing, and other forms of instructional technology. It also provides the opportunity for collaboration—among students, teachers, administrators, as well as with schools, libraries, museums, universities, and industry.

In some ways, the Internet both exacerbates and offers potential solutions to the equity issue. The Internet can deliver resources previously outside the reach of small rural or large urban schools struggling with limited resources. The Net can be a central tool in the struggle to provide world-class resources to all children. But the more central the Internet becomes as an instructional resource, the more significant the impact of limited access to that resource. What happens to students in schools with limited access to the Internet and other supporting instructional technologies? What happens to those families that do not have ready access to the Internet and thus to its wealth of resources as well as the specialized communications within the school community it makes possible? Public access points, such as community centers and libraries, can help take up the slack, but they pale in face of the experience of students growing up with their own computers with Internet access. E-rate funding is helping to level the playing field for schools and libraries; in turn, these institutions need to find creative ways to extend their new capabilities to the wider community to make sure that the promise of the Internet is realized for all students.

Internet Access – User Profile

- Middle/junior high, senior high
- Large (more than 1,000 students)
- Low poverty-level enrollments (under 6%)
- Low minority enrollments (under 5%)
- Favorable student-to-computer ratios (6 or fewer students per computer)

National Penetration and Enrollment

With Internet penetration now standing at 94%, the growth rate continues to slow, as happens for mature technologies. In the period from 1998 to 2000, Internet access increased by 11%, from 85% in 1998 to 94% in 2000. (See Figure 41.)

What is amazing about Internet access is how rapidly this technology has approached the point of being nearly universal. In the period from 1997 to 2000, Internet access nearly tripled, growing from 32% in 1996-97 to today's 94% penetration level.

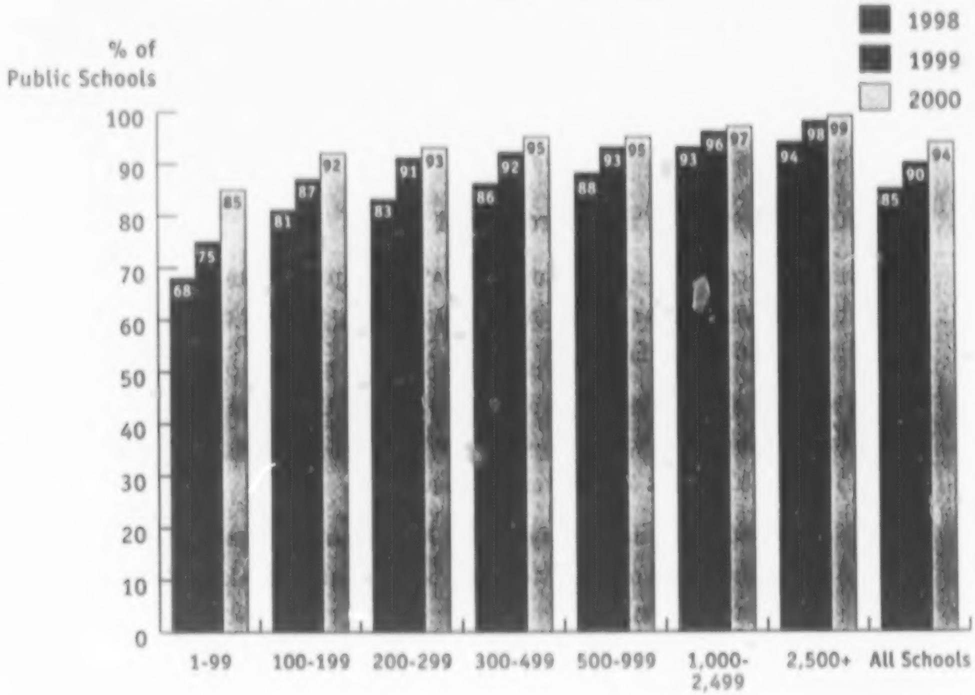
The larger the school, the more likely it is to have Internet access. Ninety-seven percent or more of the largest schools (1,000 or more students) have Internet access compared to 85% of the smallest schools (under 100 students).

Internet access varies by state, ranging from a high of 100% in Delaware, Hawaii, and Vermont to a low of 82% in Nevada. (See Table 38 and Figure 42.) Nine states report Internet access penetrations of 98% or more of all schools. Only seven states—Pennsylvania, Oklahoma, Alabama, Louisiana, Mississippi, New Mexico, and Nevada—report Internet access penetrations below 90%, which was the national average in 1999.

Middle/junior high schools (97%) and senior high schools (96%) are most likely to report having Internet access, followed by combined schools at 94% and elementary schools at 93%. Adult/special/voc. ed. schools reported the lowest levels of Internet access, 89%. (See Table 37.) Because these specialized schools often do not operate at traditional school sites, districts and states may be slower in extending Internet connections to them.

Figure 41

Internet Penetration by School Enrollment 1998-2000



Source: Market Data Retrieval, 2000, Public School Findings.

Table 37

Internet Access Penetration: School Type by School Enrollment

School Type	All Schools (%)	1-99 (%)	100-199 (%)	200-299 (%)	300-499 (%)	500-999 (%)	1,000-2,499 (%)	2,500+ (%)
Elementary	92.7	84.4	90.6	91.2	93.8	94.5	93.6	100.0
Middle/Junior High	96.5	83.0	97.9	97.8	95.9	96.8	96.8	100.0
Senior High	96.1	88.9	96.7	97.6	97.1	96.7	97.3	98.3
Combined	94.3	85.0	96.6	98.1	96.1	98.6	94.1	100.0
Adult/Special/Voc. Ed.	88.5	80.2	81.6	92.1	96.0	96.3	96.9	100.0
Total	**93.8**	**85.1**	**92.3**	**93.3**	**94.5**	**95.4**	**96.5**	**98.6**

Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Table 38

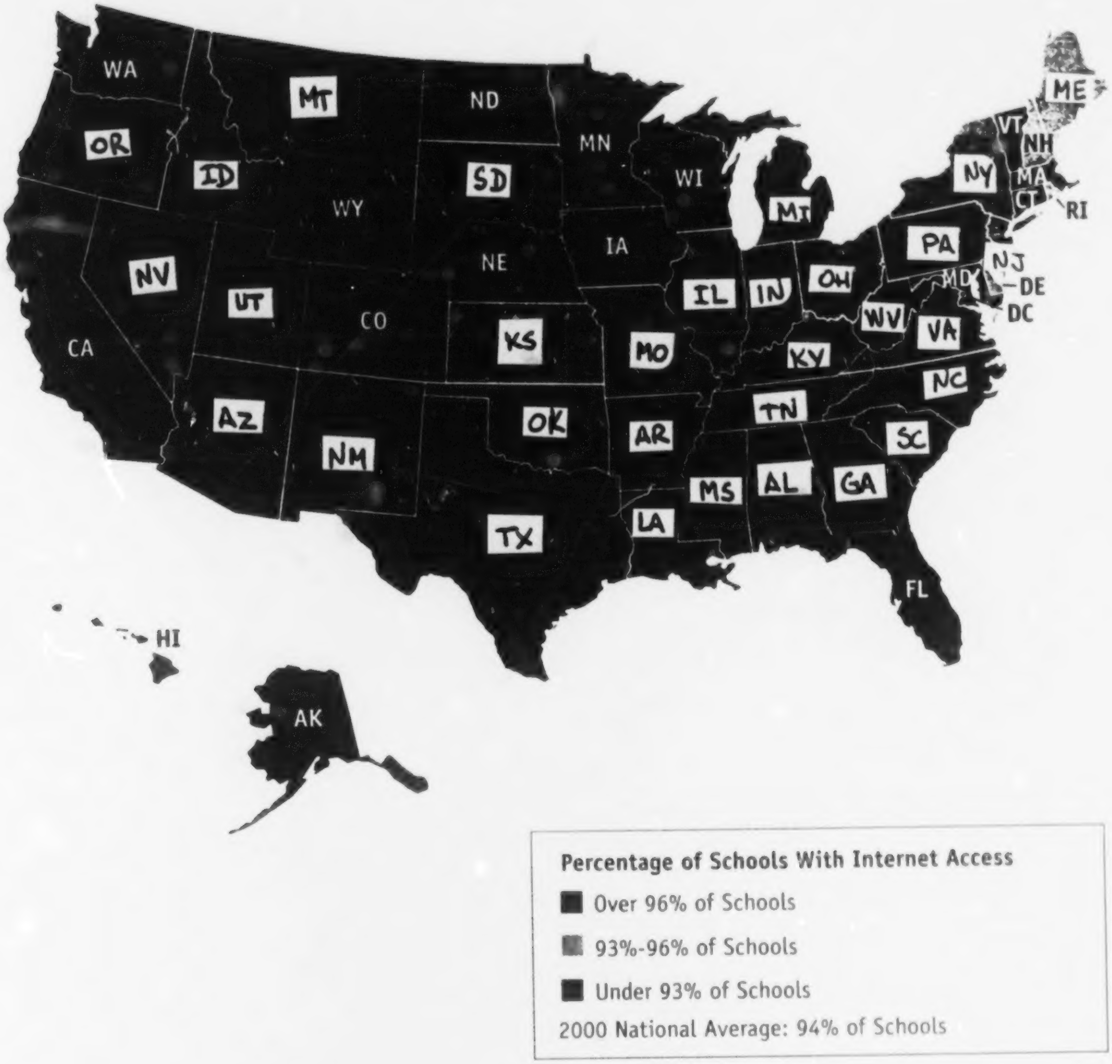
Schools With Internet Access

State	School Penetration (%)	
Delaware	100.0	
Hawaii	100.0	
Vermont	100.0	
Nebraska	99.5	
Utah	98.9	
Tennessee	98.5	
Alaska	98.3	
West Virginia	98.2	
Maine	98.1	
Minnesota	97.9	
Idaho	97.9	
Wisconsin	97.6	
Colorado	97.4	
North Carolina	96.9	
Arkansas	96.8	
South Carolina	96.7	
Virginia	96.7	
New Hampshire	96.3	
Kansas	96.2	
Wyoming	96.1	
Georgia	95.8	
Connecticut	95.7	
Florida	95.7	
Oregon	95.6	
Washington	95.5	
Texas	95.3	
Missouri	95.3	
Iowa	95.2	
Montana	94.7	
Indiana	94.3	
North Dakota	94.3	
Maryland	94.2	
Kentucky	94.1	*National Average 93.8%*
Michigan	92.5	
South Dakota	92.4	
New Jersey	92.3	
Ohio	92.3	
District of Columbia	91.2	
Massachusetts	90.6	
Rhode Island	90.6	
California	90.5	
Arizona	90.3	
New York	90.2	
Illinois	90.1	
Pennsylvania	89.9	
Oklahoma	89.0	
Alabama	88.6	
Louisiana	87.7	
Mississippi	87.6	
New Mexico	86.3	
Nevada	82.4	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 42

Schools With Internet Access



BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

Poverty Level

Poverty level indicates the percentage of children below the poverty line in the district. The higher a district's poverty level, the poorer the community it serves. Schools in districts with higher percentages of poverty-level students report significantly lower percentages of Internet access. While 96% of schools with under 6% poverty-level enrollments report Internet access, only 90% of schools with 30% or more poverty-level enrollments do so.

It would appear that poorer students have less access to the Internet. (See Figure 43.) The gap continues to narrow, however. The percentage of schools with high (over 30%) poverty-level enrollments reporting Internet access grew by 7% between 1999 and 2000 compared to 2% growth among schools with low (under 6%) poverty-level enrollments. These high poverty-level schools present some of the bigger problems with respect to retooling their infrastructure to deal with modern communications technology. These are the schools that the E-rate program was designed to benefit most, since their allowable discount is calculated on the percentage of poor students served.

Table 39

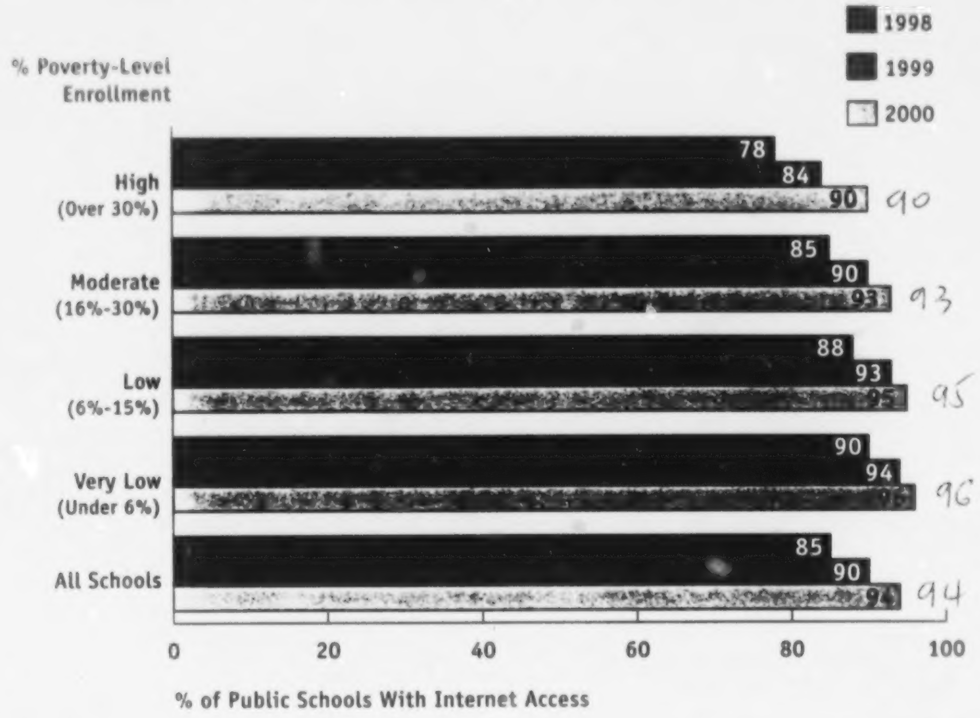
Internet Access Penetration: School Type by Poverty Level

School Type	All Schools (%)	0%-5.9% (%)	6%-15.9% (%)	16%-29.9% (%)	30%+ (%)
Elementary	92.7	95.1	94.4	92.0	88.9
Middle/Junior High	96.5	97.1	96.9	96.4	95.4
Senior High	96.1	98.6	97.3	95.6	93.8
Combined	94.3	95.9	96.3	95.2	89.9
Adult/Special/Voc. Ed.	88.5	89.7	92.9	87.8	78.1
Total	**93.8**	**95.8**	**95.3**	**93.3**	**90.2**

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 43

Internet Access by Poverty Level 1998-2000



Source: Market Data Retrieval, 2000, Public School Findings.

Student Need Indicator

Student need indicator represents the percentage of a public school's enrollment which qualifies for the free lunch program. Updated yearly, qualification for free lunch is based on family size and income criteria. The lower the student need indicator percentage, the better the economic situation in the households of the students attending the school. Free lunch population is one of the indicators used to calculate the discount a school is eligible for under the E-rate.

Schools in districts with higher percentages of students qualifying for free lunch (51% or more) report somewhat lower percentages of Internet access. (See Table 40.) While 96% of schools with low student need indicator (below 11%) report Internet access, 92% of schools with high student need indicator (51% or more) do so. The gap has closed considerably, possibly a result of the E-rate. In 1999, 93% of schools with low student need had Internet access compared to only 87% of schools with high student need.

BEST COPY AVAILABLE

Table 40

Internet Access Penetration: School Type by Student Need Indicator

School Type	All Schools (%)	0%-10% (%)	11%-20% (%)	21%-30% (%)	31%-50% (%)	51%+ (%)
Elementary	92.7	95.1	95.6	94.6	93.9	91.2
Middle/Junior High	96.5	98.0	97.3	96.8	96.1	95.1
Senior High	96.1	97.9	98.3	96.6	97.1	91.2
Combined	94.3	98.5	97.7	98.7	97.8	91.2
Adult/Special/Voc. Ed.	88.5	88.9	92.3	72.7	86.1	81.0
Total	**93.8**	**96.1**	**96.6**	**95.5**	**94.9**	**91.5**

Source: Market Data Retrieval, 2000, Public School Findings.

Computer Intensity

Schools with favorable computer intensities are more likely to have Internet access than are schools with less favorable levels. Schools with 30 or more students per computer have the lowest level of Internet access (67%). On the other hand, 96% of schools with the most favorable student-to-computer ratios (three or fewer students per computer) have Internet access. Schools with favorable student-to-computer ratios have a significant number of computers in place and are well positioned to benefit from accessing outside resources via the Internet. Schools at the other end of the spectrum are faced with the need to make significant investments just to improve their student-to-computer ratios; they may have significant infrastructure problems and appear to be having a harder time implementing Internet access. These are the same schools that could benefit most from the access to resources that the Internet provides.

Table 41

Internet Access Penetration: School Type by Computer Intensity

School Type	All Schools (%)	1-3 (%)	4-6 (%)	7-9 (%)	10-14 (%)	15-19 (%)	20-29 (%)	30+ (%)
Elementary	92.7	95.5	94.8	93.1	89.2	83.4	72.9	64.3
Middle/Junior High	96.5	97.7	98.2	93.9	95.1	93.7	88.6	68.4
Senior High	96.1	96.5	96.8	96.6	92.6	92.6	87.5	70.6
Combined	94.3	94.6	97.1	92.9	97.0	66.7	50.0	50.0
Adult/Special/Voc. Ed.	88.5	90.6	86.5	90.3	91.7	85.7	79.4	81.8
Total	**93.8**	**95.8**	**95.6**	**93.6**	**90.5**	**85.2**	**75.9**	**67.0**

Source: Market Data Retrieval, 2000, Public School Findings.

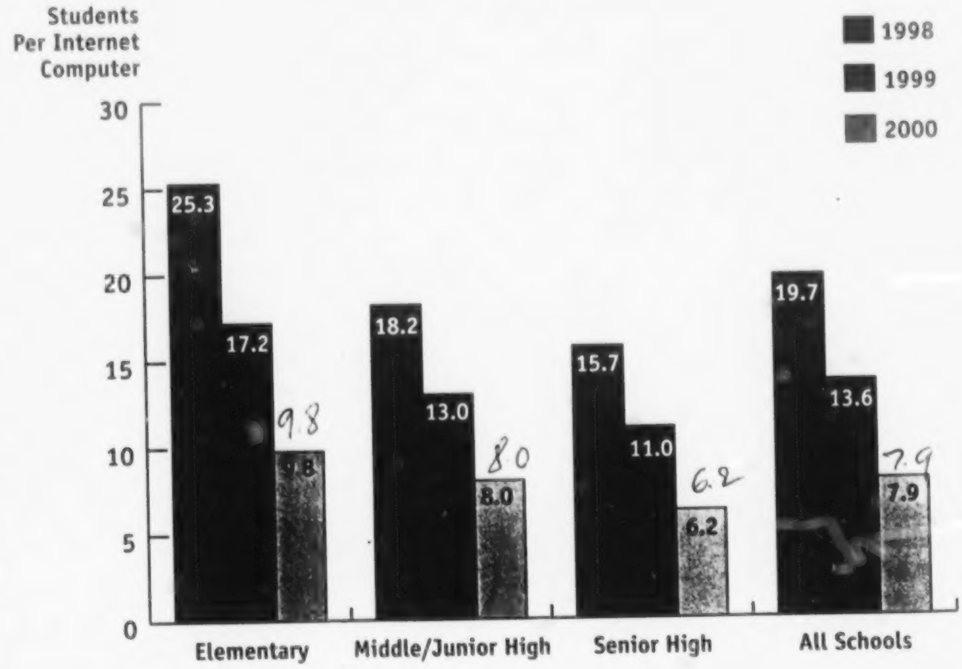
Internet Computer Intensity

Internet computer intensity (students to computer with Internet access ratio) is 7.9, compared to 6.4 students per networked computer and 4.9 students per computer for the total installed base of instructional-use computers. Individual state Internet computer intensities range from 12.6 students in the District of Columbia to an attractive 4.6 in South Dakota. (See Table 42 and Figure 45.)

When Internet computer intensity is considered, senior high schools fare best, with an Internet computer intensity of 6.2 students per computer with Internet access. Elementary schools have the least favorable Internet computer intensity, 9.8 students per computer with Internet access, with middle/junior high schools reporting 8.0 students per computer with Internet access. Elementary schools are gaining rapidly in terms of computer intensity, as can be seen in Figure 44.

Figure 44

Internet Computer Intensity by School Type 1998-2000



Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Table 42

Internet Computer Intensity

	Stat	Students Per Internet Access Computer	
Least Access	District of Columbia	12.6	
	California	12.4	
	Alabama	11.6	
	Louisiana	11.4	
	Nevada	11.3	
	Mississippi	11.1	
	North Carolina	11.0	
	New Hampshire	10.4	
	New York	9.8	
	Rhode Island	9.6	
	New Mexico	9.3	
	Florida	9.0	
	Tennessee	9.0	
	Maryland	9.0	
	Massachusetts	9.0	
	Connecticut	8.9	
	New Jersey	8.9	
	Pennsylvania	8.8	
	Hawaii	8.8	
	Michigan	8.7	
	Georgia	8.3	
	Arkansas	8.1	
	Oregon	8.1	
	Colorado	8.0	*National Average 7.9*
	Illinois	7.8	
	Utah	7.7	
	Virginia	7.5	
	Washington	7.5	
	Texas	7.3	
	South Carolina	7.1	
	Kentucky	7.1	
	Oklahoma	7.0	
	Montana	6.9	
	Indiana	6.8	
	Wisconsin	6.7	
	Missouri	6.6	
	Idaho	6.5	
	Vermont	6.4	
	West Virginia	6.3	
	Maine	6.2	
	Minnesota	6.2	
	Arizona	6.1	
	Kansas	6.0	
	North Dakota	5.7	
	Iowa	5.6	
	Delaware	5.1	
	Nebraska	5.1	
	Wyoming	4.9	
	Ohio	4.9	
	Alaska	4.8	
Greatest Access	South Dakota	4.6	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 45

Internet Computer Intensity

Students Per Internet Access Computer

■ Under 6.8 Students

▨ 6.8-8.8 Students

■ Over 8.8 Students

2000 National Average: 7.9 Students

BEST COPY AVAILABLE

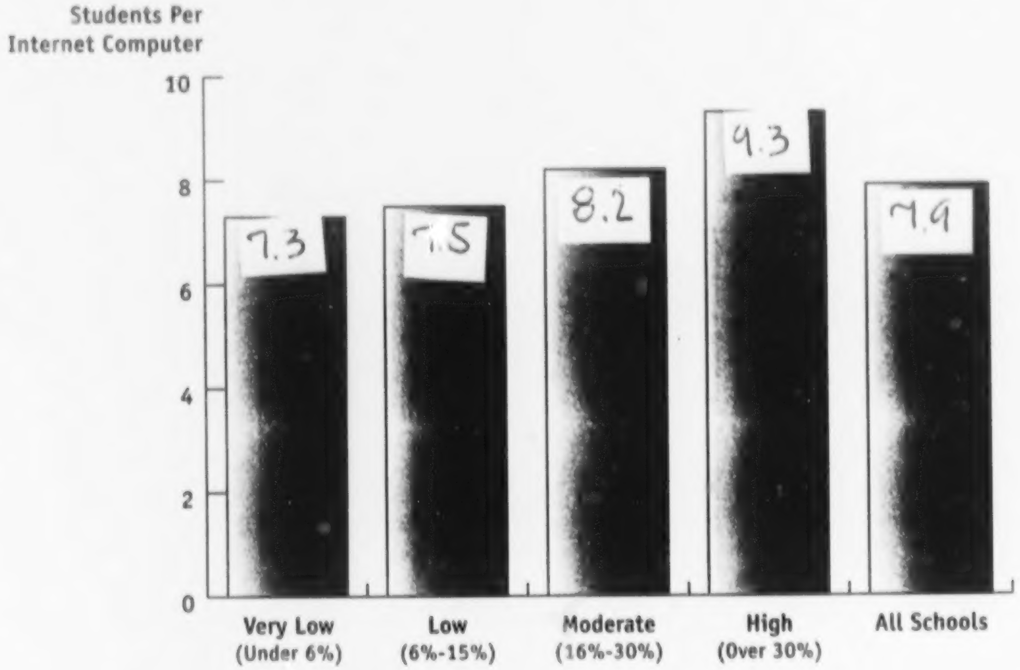
Source: Market Data Retrieval, 2000, Public School Findings.

Internet Computer Intensity by Poverty Level

Not only do poor students have less access to the Internet, as described in the previous section, they also have a higher number of students sharing Internet-connected computers. The average Internet intensity among schools with high (over 30%) poverty-level enrollments is 9.3 students per computer with Internet access compared to an intensity of 7.3 among schools with low (under 6%) poverty-level enrollments. Students in poorer schools are experiencing the effects of the digital divide.

Figure 46

Internet Computer Intensity by Poverty Level



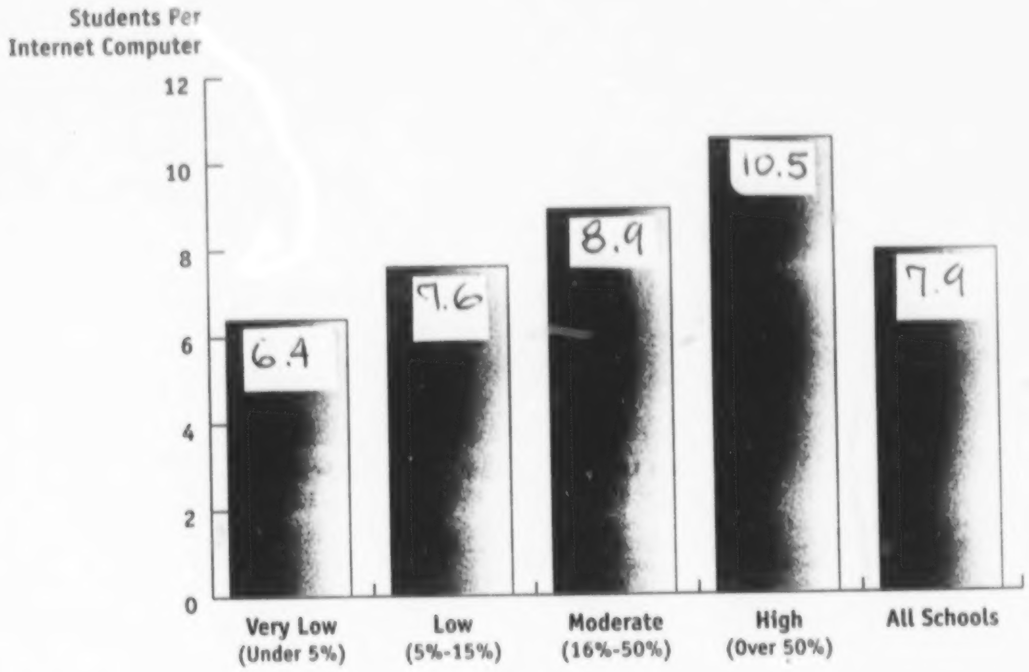
Source: Market Data Retrieval, 2000, Public School Findings.

Internet Computer Intensity by Minority Enrollment

Students in schools with high percentages of minority students have significantly more limited access to Internet-connected computers. Schools with over 50% minority enrollments average 10.5 students per computer with Internet access compared to 6.4 for schools with fewer than 5% minority enrollments. Thus schools with high percentages of minority students have less favorable Internet computer intensities than the national average of 7.9. They compare even less favorably to schools with low minority enrollments. Four more students share every Internet-connected computer in these schools with the highest minority enrollments than do their counterparts in schools with limited numbers of minority students. Children from minority groups are definitely on the wrong side of the digital divide with respect to ready access to the Internet and its resources.

Figure 47

Internet Computer Intensity by Minority Enrollment



Source: Market Data Retrieval. 2000, Public School Findings.

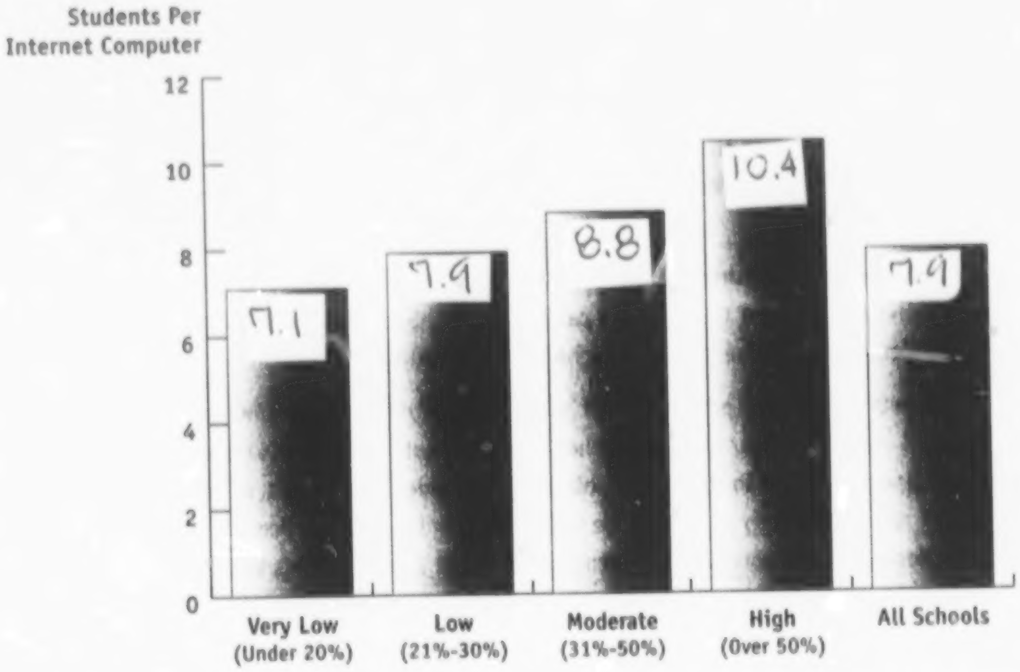
Internet Computer Intensity by Student Need Indicator

Student need indicator represents the percentage of a public school's enrollment, which qualifies for the free lunch program. Updated yearly, qualification for free lunch is based on family size and income criteria. The lower the student need indicator percentage, the better the economic situation in the households of the students attending the school. Free lunch population is one of the indicators used to calculate the discount a school is eligible for under the E-rate.

Schools in districts with higher percentages of students qualifying for free lunch average 10.4 students per computer with Internet access compared to an intensity of 7.1 among schools with low student need indicator.

Figure 48

Internet Computer Intensity by Student Need Indicator



Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Internet Connection Type

Schools with Internet access were asked to indicate how they gained access to the Internet. The largest percentage of schools (59%) access the Internet via T1 lines, a 20% increase from the year earlier. Twenty-one percent use standard modems to access the Internet. Thirteen percent use a 56Kb line, 9% report using an ISDN connection, and 9% use cable modems to access the Internet. (See Figure 49.)

The percentage of schools using some form of dial-up access to reach the Internet continues to decrease or remain relatively unchanged from the prior survey year. At one time the most common way computers connected to any network was through a standard dial-up connection, using a modem and a standard phone line. Such connections typically transmit data at relatively slow speeds, in the range of 28.8Kb to 56Kb. Dial-up access over an ISDN line can reach speeds of 128Kb, but ISDN service is expensive and unavailable in some areas.

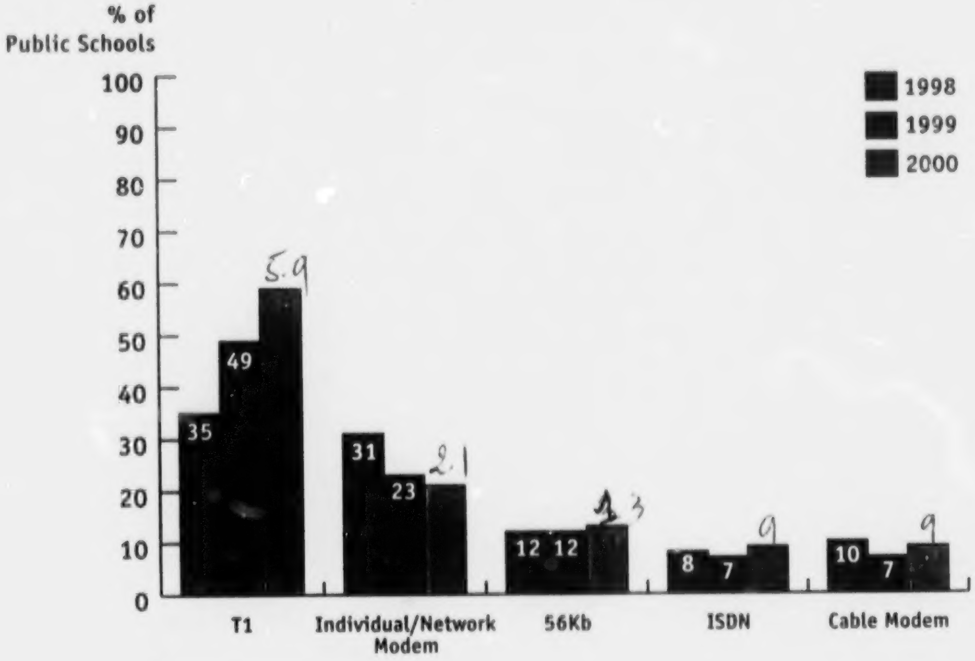
Today an increasing number of schools access the Internet via some form of dedicated network connection, as opposed to dial-up access. A dedicated connection is established and remains fixed between two points; it is devoted exclusively to the task of sending information. These dedicated connections—56Kb lines, T1 lines, or cable modems—have the advantage of being faster and having a higher bandwidth than dial-up connections. A dedicated network connection via a T1 line operates at 1.54Mb. Cable modems also operate at very high speeds when sending data downstream but are not widely available.

Some schools are turning to satellite technology to connect to the Internet, especially in rural areas removed from wired telephone or cable networks. Satellite services are about three times faster than T1 lines. Twenty-nine percent of schools own satellite dishes.

Schools with higher percentages of students qualifying for free lunch are less likely to report the use of T1 lines. Fifty-four percent of schools with high student need (51% or more) access the Internet via T1 lines compared to 63% of schools with low student need (10% or less). High student need schools are also more likely to report the use of standard dial-up modems, with 24% of high student need schools (51% or more) using modems compared to 18% of schools with low student need (10% or less). E-rate discounts are calculated based on the percentage of students participating in the free lunch program. It is possible that the gap between high and low student need schools with respect to high-speed Internet access would be even greater without the support of E-rate funding. (See Table 43.)

Figure 49

Internet Access Connection Type 1998-2000[1]



[1] Multiple responses allowed.

Source: Market Data Retrieval, 2000, Public School Findings.

Table 43

Internet Access Connection Type by Student Need Indicator[1]

Connection Type	0%-10% (%)	11%-20% (%)	21%-30% (%)	31%-50% (%)	51%+ (%)
T1	63.3	61.9	60.4	56.4	54.1
Individual/Network Modem	17.7	16.6	18.2	22.9	24.0
56Kb	8.3	14.7	14.5	12.7	11.3
ISDN	6.8	7.5	6.9	6.7	9.3
Cable Modem	8.1	8.4	7.2	9.5	10.4
Total	**104.2**	**109.1**	**107.2**	**108.2**	**109.1**

[1] Multiple responses allowed.

Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

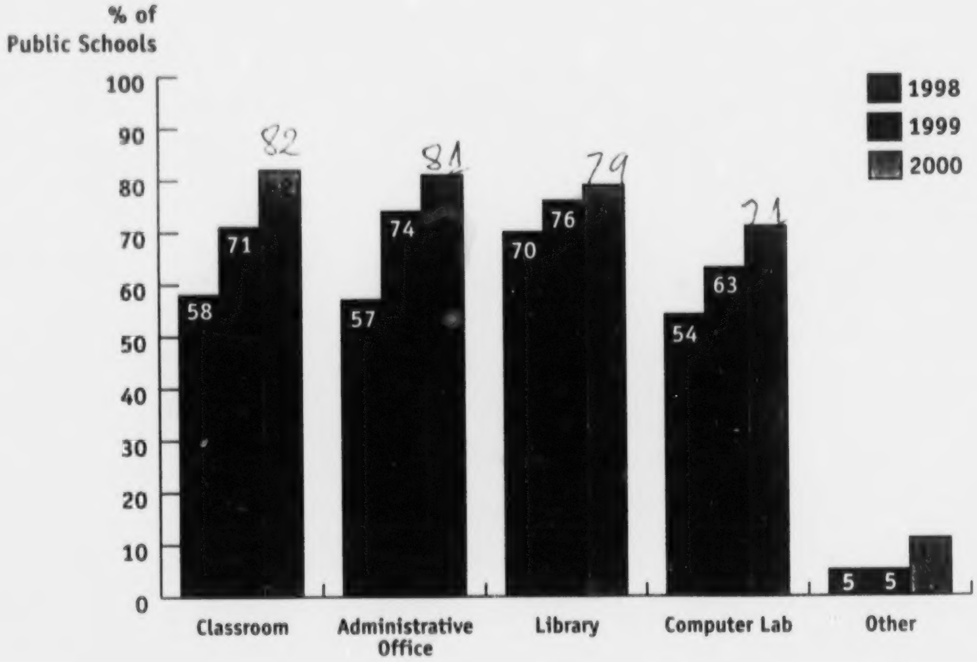
Locations of Internet Access

Schools were asked to indicate where the computers with Internet access are located. Schools provide Internet access in multiple locations. Library access allows students to surf the Web for resources related to assignments as well as for their own personal interests, while access in classrooms and computer labs allows teachers working in those locations to access the Web directly to support instruction or to teach about the Internet itself.

Nearly 80% of schools report that they provide Internet access in the library. The computers connected to the Internet in a library can be used throughout the school day and after school as well, given that it is relatively easy to supervise this centralized location. More schools provide Internet access in classrooms (82%) than in computer labs (71%). More than 80% of schools also provide Internet access in the administrative office so that school administrators, teachers, and support staff have regular access to the Net.

Figure 50

Internet Access by Location 1998-2000



Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

In general, within each location category, the percentage of schools reporting Internet access increases as grade level rises, though the major difference is found between the elementary schools and most other types of schools. Middle/junior high schools are most likely (90%) to report having Internet access in libraries/media centers. Elementary schools are least likely to provide Internet access in computer labs. Only 64% of elementary schools report computer lab Internet access compared to 84% of middle/junior high schools, 83% of senior high schools, and 82% of combined schools.

At least 80% of all types of schools now report having Internet access in at least some of their classrooms. At the middle/junior high school level, the percentage of schools reporting access in computer labs and classrooms is nearly equal, 84% and 85%, respectively. Slightly more senior high schools report classroom access (88%) than computer lab access (83%). The pattern is the opposite among elementary schools, where 80% report classroom access as opposed to 64% computer lab access.

Table 44

Internet Access by School Type and Location[1]

School Type	Classroom (%)	Administrative Office (%)	Library (%)	Computer Lab (%)	Other (%)
Elementary	79.6	79.1	78.7	63.5	11.2
Middle/Junior High	84.7	82.3	89.5	83.9	10.0
Senior High	88.4	82.9	81.7	82.9	10.3
Combined	89.8	83.2	76.3	81.8	8.9
Adult/Special/Voc. Ed.	79.4	81.3	34.4	58.2	9.2
Total	**82.4**	**80.5**	**79.4**	**70.6**	**10.7**

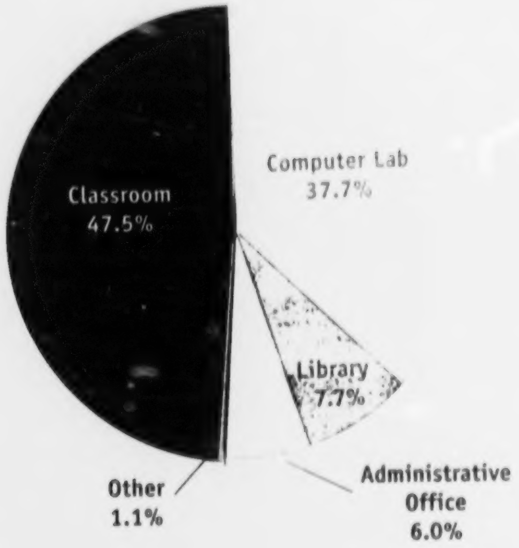
[1] Based on respondents who indicated Internet access location.

Source: Market Data Retrieval, 2000, Public School Findings.

Schools also reported on the number of computers with Internet access by location. In 2000 distribution of Internet-connected computers shifted very little, perhaps indicating that the schools have found a distribution pattern with which they are relatively content. Of the computers reported, the bulk remains distributed between classrooms and computer labs. Forty-eight percent of computers with Internet access are located in classrooms and 38% are found in computer labs. Though the majority of schools report Internet access from the library, the number of computers with Internet access located in libraries is low, with only 8% of Internet-connected computers found in libraries and 6% in administrative offices. (See Figure 51.)

Figure 51

Computers With Internet Access by Location



Source: Market Data Retrieval, 2000, Public School Findings.

Classrooms With Internet Access

Within schools that have extended the Internet to the classroom, 80% of their classrooms are connected to the Internet. Among schools connecting classrooms to the Internet, elementary schools report the highest percentage of Internet-connected classrooms, 81%, followed by 79% of classrooms in middle/junior high schools and 77% of classrooms in senior high schools.

Table 45

Classrooms With Internet Access by School Type

School Type	**Classrooms With Internet (%)**
Elementary	81.2
Middle/Junior High	79.2
Senior High	76.6
Combined	84.2
Adult/Spec/Voc. Ed.	72.0
Total	**79.5**

Should be read as: Within schools reporting at least one classroom with Internet access, 79.5% of the classrooms have Internet access.

Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Internet Use for Instructional Purposes

As Internet access becomes more widespread, the question arises as to what it is the schools do with the Internet. As with all technology, the issue is never simply access but how the technology is employed to support teaching and learning. Schools with Internet access were asked to report the percentage of their teachers who use the Internet for instructional purposes. Sixty-three percent of public schools indicate that the majority (50%+) of their teachers use the Internet for instructional purposes. The degree of teacher instructional use varies by state. In North Dakota and Alaska, 85% of responding schools report that the majority of their teachers use the Internet for instruction. Only 32% of the schools in the District of Columbia indicate that the majority of their teachers use the Internet for instruction. (See Table 46 and Figure 52.)

It is interesting to note that North Dakota, Alaska, Nebraska, and South Dakota are among the top five states reporting high Internet usage for instructional purposes. Population density in these states is low and many schools are located in rural areas with little access to extensive library, cultural institution, or university resources. In some locations, distance and weather isolate students and teachers for extended periods of time. In these instances, the Internet can be a central resource not only for connecting to information and reference materials but for connecting to other teachers and students and broadening the curriculum via these connections.

Table 46

Teachers Using the Internet

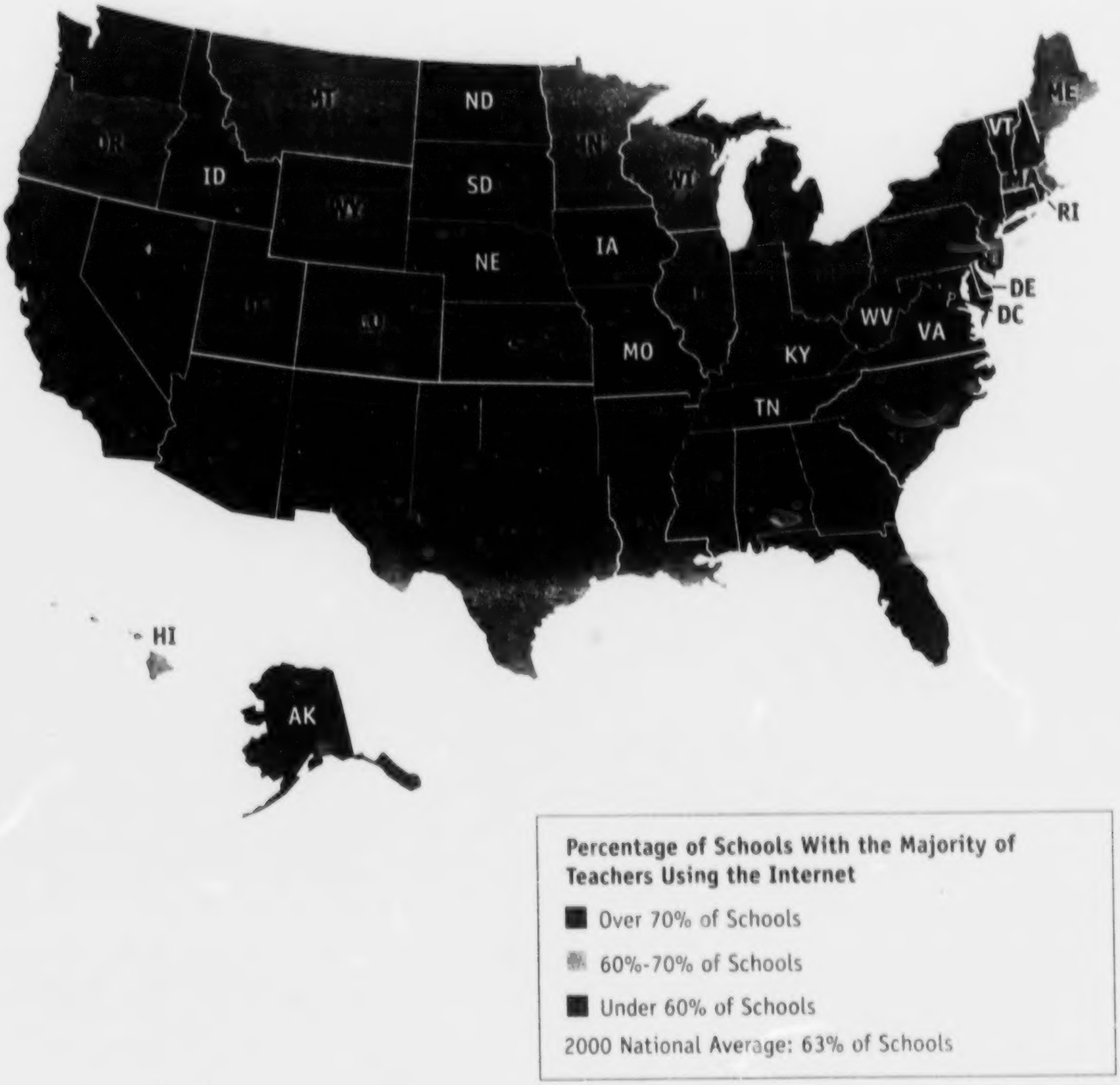
State	School Penetration (%)[1]	
North Dakota	85.4	
Alaska	84.5	
Nebraska	79.6	
South Dakota	79.3	
Virginia	74.9	
Rhode Island	73.2	
Iowa	72.8	
Vermont	72.7	
Idaho	72.6	
Tennessee	71.5	
Kentucky	71.3	
West Virginia	70.7	
Missouri	70.5	
Minnesota	69.9	
South Carolina	69.9	
Ohio	69.7	
Maine	69.6	
Montana	68.4	
Kansas	67.8	
Wyoming	66.2	
Illinois	66.0	
Utah	65.5	
Mississippi	64.9	
Texas	64.6	
Colorado	64.2	
New Jersey	63.9	
Wisconsin	63.9	
Oregon	62.9	
Hawaii	62.8	*National Average 62.6%*
Louisiana	60.3	
Delaware	59.5	
Massachusetts	59.5	
North Carolina	58.6	
Oklahoma	58.4	
Alabama	57.7	
Washington	57.5	
New Mexico	56.9	
New Hampshire	56.5	
Michigan	56.5	
Arkansas	55.1	
Maryland	54.7	
California	54.6	
Pennsylvania	54.2	
Arizona	53.9	
Nevada	53.8	
Georgia	53.5	
New York	53.3	
Indiana	53.2	
Connecticut	50.8	
Florida	46.8	
District of Columbia	32.0	

[1] Percentage of schools with the majority of teachers (50%+) using the Internet for instructional purposes.

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 52

Teachers Using the Internet


ME
VT
ND
ID
SD
NE
IA
RI
DE
WV
DC
VA
MO
KY
TN
HI
AK
Percentage of Schools With the Majority of Teachers Using the Internet
■ Over 70% of Schools
▨ 60%-70% of Schools
■ Under 60% of Schools
2000 National Average: 63% of Schools

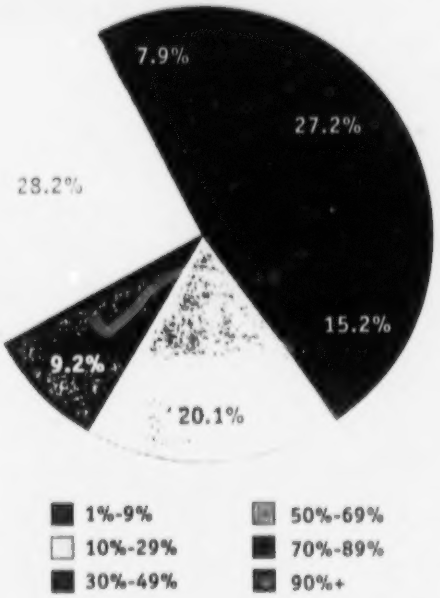
BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

Twenty-seven percent of schools report that virtually all—90% or more—of their teachers use the Internet for instructional purposes and 35% report instructional use between 50% to 89% of teachers. Thus 63% of schools now report that the majority (more than 50%) of their teachers use the Internet for instruction compared to 54% of schools reporting this level of use in 1999. As Internet access becomes more reliable and ubiquitous, teachers have begun to actively explore its uses in instruction. The percentage of teachers using the Internet regularly to enhance students' learning experiences will continue to grow.

Figure 53

Schools by Percentage of Teachers Using the Internet for Instruction



Should be read as: In 27.2% of all the schools, 90% or more of the teachers are using the Internet.

Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Schools Subscribing to Online Curriculum Content

One method of effectively exploiting the Internet for instruction is to subscribe to an online service that delivers instructional content. Among the more familiar of these services are Britannica Online, CCCnet, Riverdeep, and the Lightspan Network. These services develop, aggregate, and screen content and help build online communities. Users can be assured of appropriate and safe content, correlated to the school curriculum. The services may also offer projects and activities; opportunities for collaboration, chat rooms, and e-mail communication; special resources for teachers; and collections of links to other content-rich sites. They save teachers the time and effort involved in creating their own online activities and searching out supporting sites to which to link.

However, this is an arena where the business model is still evolving in terms of free versus fee-based content. Education portals, such as bigchalk.com and AOL@School, have developed free services that aggregate content (some of which may be subscription-based), provide communications tools, and often host school or classroom homepages. At the same time, the amount of free content on the Web that is coming from trusted sources, such as National Geographic, the Smithsonian, NASA, and others, has grown rapidly and teachers are beginning to be more confident of their own and their student's Web-surfing abilities.

Thirteen percent of schools report that they subscribe to fee-based, online curriculum content. Since online content is still a fairly new area, it is not uncommon to find that some entity in the state department of education has taken a leadership role in seeking out and funding the acquisition of online curriculum resources. In Illinois, for example, the State Department of Education has been very aggressive in negotiating statewide contracts with content providers, such as Encyclopedia Britannica, that offer schools attractive and/or subsidized subscription prices. (See Table 48 and Figure 54.)

Elementary schools are less likely to subscribe to online curriculum content than are middle/junior high and senior high schools. Roughly 30% of middle/junior high and senior high schools indicate they subscribe to online curriculum content. It may be that older students are perceived as better able to use such materials.

Table 47

Online Curriculum Subscribers by School Type

School Type	**Schools (%)**
Elementary	11.8
Middle/Junior High	15.6
Senior High	15.2
Combined	14.3
Adult/Special/Voc. Ed.	9.7
Total	**13.0**

Source: Market Data Retrieval, 2000, Public School Findings.

Table 48

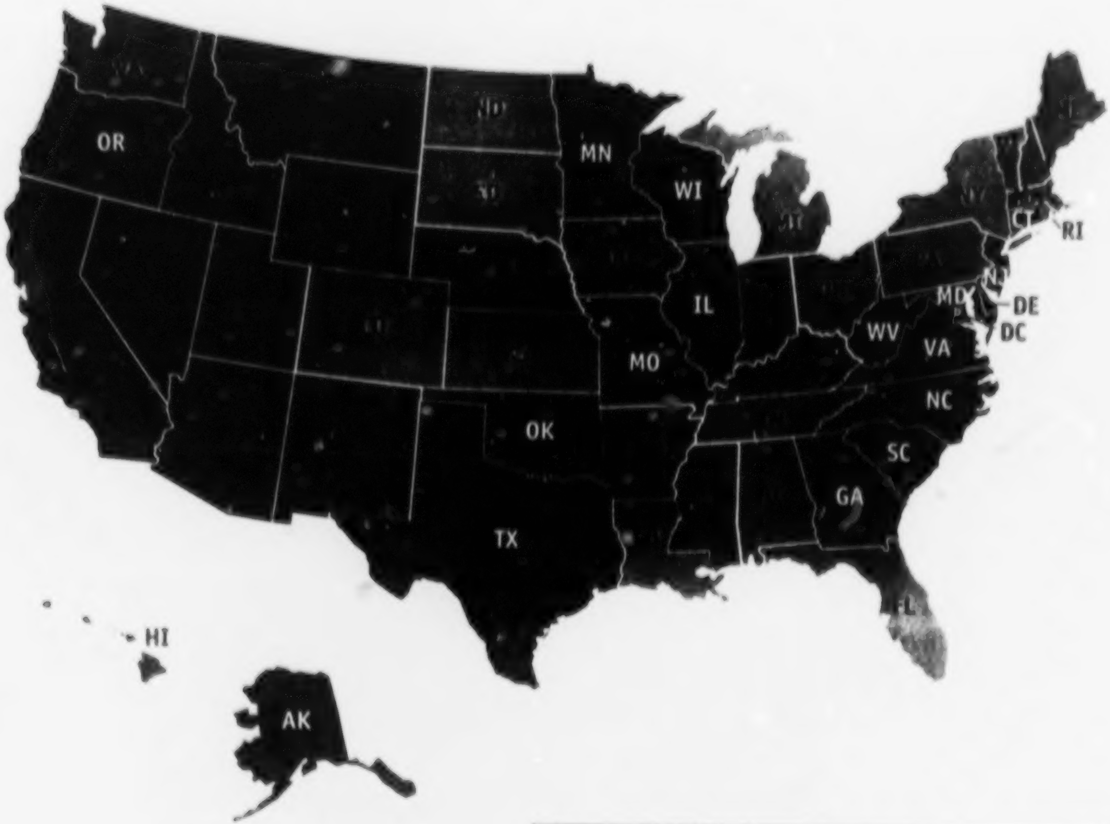
Online Curriculum Content Subscribers

State	School Penetration (%)	
Illinois	21.4	
North Carolina	18.6	
Maryland	17.7	
Missouri	17.5	
Virginia	17.4	
New Jersey	16.0	
Texas	15.0	
Minnesota	14.4	
Oklahoma	14.4	
Delaware	14.3	
Alaska	14.2	
West Virginia	14.1	
Wisconsin	13.9	
Georgia	13.9	
Oregon	13.8	
South Carolina	13.6	
Connecticut	13.5	
North Dakota	13.3	
Alabama	13.1	
Iowa	13.0	*National Average 13.0%*
Kansas	12.9	
Louisiana	12.5	
Ohio	12.4	
Michigan	12.3	
Pennsylvania	12.1	
New York	12.0	
Colorado	11.8	
District of Columbia	11.8	
Tennessee	11.5	
Florida	11.1	
Washington	10.7	
South Dakota	10.7	
Massachusetts	10.4	
Wyoming	10.4	
Idaho	10.3	
Kentucky	10.3	
Nebraska	10.0	
Arkansas	9.8	
Arizona	9.7	
Vermont	9.6	
Indiana	9.5	
Mississippi	9.3	
Hawaii	8.9	
Maine	8.9	
California	8.6	
Montana	8.3	
Utah	8.2	
Rhode Island	7.5	
New Mexico	7.2	
New Hampshire	6.4	
Nevada	4.4	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 54

Online Curriculum Content Subscribers



Percentage of Schools With the Majority of Teachers Being Online Curriculum Content Subscribers

■ Over 13% of Schools

■ 11%-13% of Schools

■ Under 11% of Schools

2000 National Average: 13% of Schools

BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings

E-Mail Accounts

Schools were asked about the percentage of teachers who have school-based e-mail addresses. The penetration of e-mail has grown rapidly. Over three-fourths of schools (77%) indicate that the majority (50% or more) of their teachers have school-based e-mail accounts. (See Table 49 and Figure 56.)

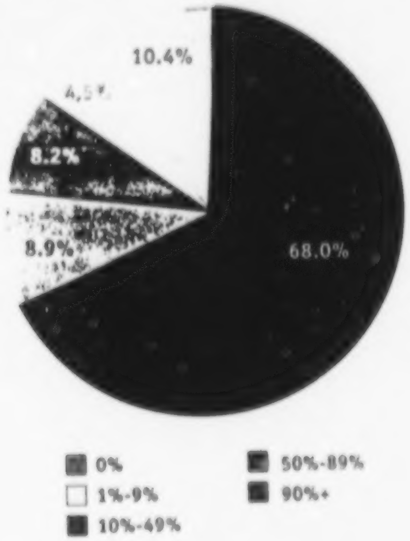
Over two-thirds (68%) of schools report that virtually all (90% or more) of their teachers have school-based e-mail accounts, up from 55% of schools in 1999. This suggests that once a school begins to offer school-based e-mail accounts, nearly every teacher wants to take advantage of the opportunity. Thirteen percent of schools indicate that between 1% to 49% of their teachers have school-based e-mail accounts and another 9% report such accounts between 50% to 89% of their teachers. The percentage of schools reporting that none of their teachers have school-based e-mail accounts decreased from 14% in 1999 to 10% in 2000.

MDR conducted a research study in April 1999 to explore issues relative to using e-mail and the Internet as sales and marketing tools in the K-12 school market. According to the survey findings, which were published in the *E-Mail Marketing Outlook 1999* report, approximately 40% of the teachers responded that they considered 1 to 5 e-mail solicitations per day acceptable. However, the majority (58%) reported that none were acceptable.

While e-mail offers a new channel for marketing to schools, the use of opt-in e-mail is emerging as the only truly acceptable model. Sending e-mail solicitations to educators who have not opted-in to receive them is considered SPAM, in other words, unsolicited commercial e-mail. SPAM can be deadly to companies that want to build positive and profitable relationships with educators.

Figure 55

Schools by Percentage of Teachers With E-Mail Addresses



Should be read as: In 68.0% of all the schools, 90% or more of the teachers have school-based e-mail addresses.

Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Table 49

Teachers Using E-Mail

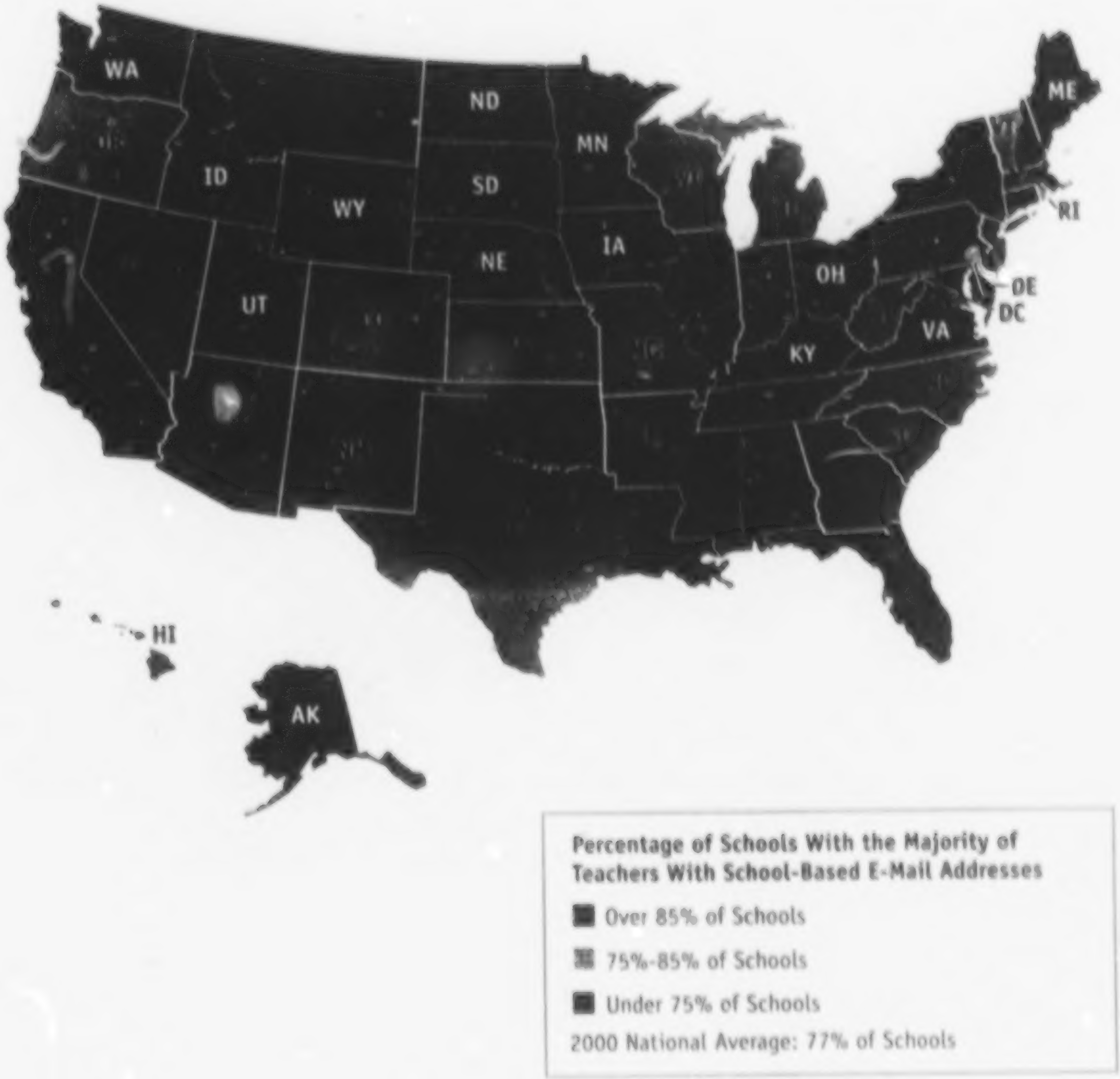
State	School Penetration (%)[1]	
Nebraska	100.0	
Delaware	97.6	
Utah	96.1	
Alaska	94.4	
Maine	94.1	
Iowa	94.0	
Idaho	92.3	
Minnesota	91.6	
Wyoming	90.5	
Hawaii	90.0	
Washington	89.5	
North Dakota	89.2	
Kentucky	87.2	
Ohio	87.2	
Virginia	86.2	
South Dakota	85.7	
Oregon	85.3	
Kansas	85.0	
Indiana	84.7	
Wisconsin	84.7	
Colorado	84.7	
Vermont	82.1	
Tennessee	81.9	
South Carolina	81.3	
Texas	80.7	
Missouri	80.5	
Arkansas	79.5	
Rhode Island	78.3	
West Virginia	78.1	
New Mexico	77.9	
North Carolina	77.0	*National Average 76.9%*
Arizona	75.9	
New Jersey	75.9	
Georgia	74.8	
Michigan	74.8	
Nevada	73.5	
New Hampshire	73.3	
Illinois	72.5	
Montana	72.2	
Massachusetts	69.2	
Florida	66.3	
Pennsylvania	66.2	
California	65.3	
Oklahoma	63.9	
Maryland	58.3	
Alabama	57.7	
New York	54.9	
Louisiana	53.9	
Mississippi	53.7	
Connecticut	39.5	
District of Columbia	20.0	

[1] Percentage of schools with the majority of teachers (50%+) with school-based e-mail addresses.

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 56

Teachers Using E-Mail



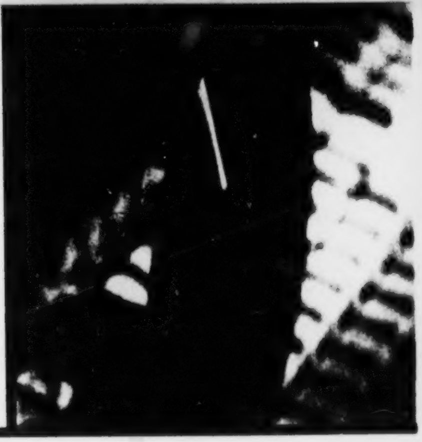
Percentage of Schools With the Majority of Teachers With School-Based E-Mail Addresses

- ■ Over 85% of Schools
- ▨ 75%-85% of Schools
- ■ Under 75% of Schools

2000 National Average: 77% of Schools

BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.



CD-ROM Use

CD-ROM drives have become a staple of the school-computing environment. As a standard feature on nearly every new computer, the penetration of CD-ROM drives in schools has grown rapidly. Schools also utilize external CD-ROM drives and CD-ROM multi-drive towers to deliver multimedia capabilities to computers.

CD-ROM technology gives schools access to a wide range of multimedia products. Once it was clear that the schools had accepted CD-ROM technology, software developers were free to produce multimedia products that appealed to every type of user and supported a variety of learning styles. Today, educators take for granted the inclusion of alternate language soundtracks and voiced directions and guidance for young users or those who need additional support to navigate through a program. High resolution graphics and video are used to model real-world processes, create simulated worlds, or simply add screen interest.

The Internet holds out the promise of delivering multimedia applications to the desktop—streaming video and audio, full-motion videoconferencing. But multimedia requires huge amounts of bandwidth, and some developers find even the high-speed lines now becoming available in schools to be inadequate for the media-rich products they envision. Hybrid CD-ROM/Internet products are being used to solve that bandwidth problem and will be used for a long time to come. Combining a Web offering with a CD-ROM permits high bandwidth resources to reside on the disc while other key elements of interaction take place online. Encyclopedia publishers have long used the Internet to download updates to users' hard drives, but new technology can now automatically index and link that new information to the original content on the CD-ROM.

CD-ROM drive speed (transfer rate) continues to increase, but otherwise the technology is static. Digital versatile (or video) disc, DVD, is the next generation of optical disc storage technology. DVD is essentially a bigger, faster CD that can hold video as well as audio and computer data. It offers storage in the range of 4.7 gigabytes on a single side, the equivalent of seven CD-ROM discs. Though beginning to appear in schools, DVD is not yet widely in use. Depending on features and capabilities, adding a DVD-ROM drive to a computer increases the cost between $80 to $240. Though this may be something of a barrier to purchase, the larger problem is that there is currently no compelling reason to turn to DVD. When it became clear that CD-ROM technology offered schools more compelling, more interactive and more powerful applications—applications that would never be offered on floppy disks—schools began to purchase CD-ROM-equipped computers in significant numbers. Until this happens for DVD or until computer manufacturers simply make DVD drives a standard part of their school offerings, it is unlikely that there will be a significant adoption of DVD technology in the school market.

CD-ROM towers are also being used more in school settings. The CD-ROM tower is a stack of individual CD-ROM drives connected to the computer network. CD-ROM towers are excellent for networks because all the CD-discs are available simultaneously to all the workstations on the network. The CD is accessed as if it was resident on the server. This is a high-performance solution for providing fast response times to multiple users.

CD-ROM – User Profile

- Average student to CD-ROM drive ratio is 7.3 to 1
- Low minority enrollments (under 5%)

CD-ROM Intensity

Nationwide, 99% of all public schools have CD-ROM drives. In 2000 the CD-ROM intensity (ratio of students to CD-ROM drives) is 7.3, roughly equivalent to the multimedia computer intensity of 7.9. This compares to 4.9 students per computer for the total installed base of instructional computers. The slight difference between CD-ROM intensity and multimedia computer intensity can be explained by the added capacity that CD-ROM towers and external drives provide.

The gap between CD-ROM intensity and overall computer intensity continues to narrow, reflecting the influx of new multimedia computers into the installed base. Individual state intensities range from 4.8 in Delaware to 11.3 in the District of Columbia. (See Table 50 and Figure 57.) Individual state CD-ROM intensity closely mirrors the multimedia computer intensity of that state as well.

Table 50

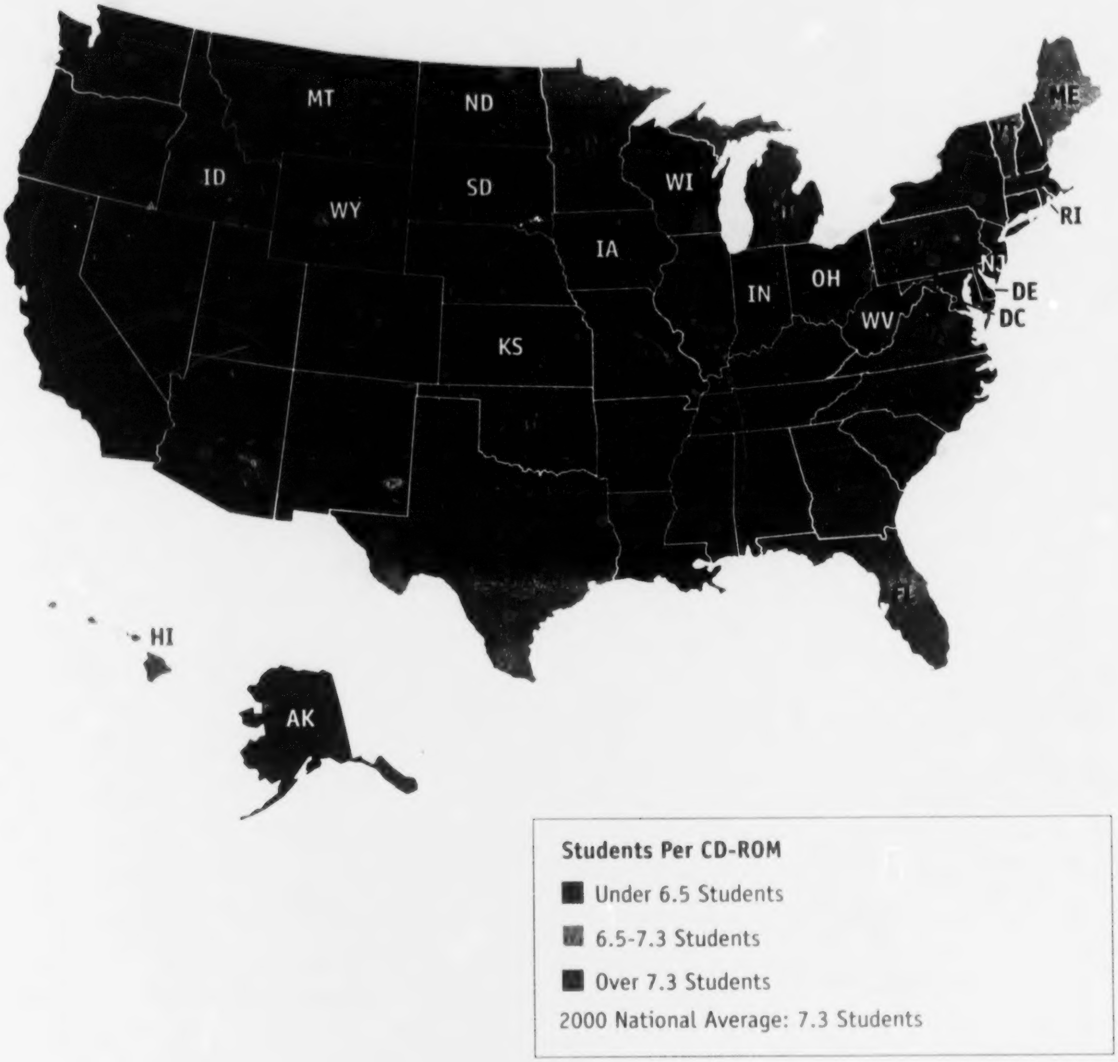
CD-ROM Intensity

	State	Students Per CD-ROM	
Least Access	District of Columbia	11.3	
	California	10.9	
	New Hampshire	10.0	
	Hawaii	9.9	
	Louisiana	9.8	
	Nevada	9.6	
	North Carolina	9.6	
	Rhode Island	9.5	
	Arizona	9.0	
	Utah	8.8	
	Maryland	8.8	
	Connecticut	8.7	
	Mississippi	8.6	
	Oregon	8.6	
	Arkansas	8.3	
	Washington	8.3	
	New York	8.2	
	Alabama	8.1	
	Tennessee	8.1	
	New Mexico	7.7	
	Kentucky	7.5	
	Massachusetts	7.5	
	Colorado	7.4	*National Average 7.3*
	Michigan	7.2	
	Pennsylvania	7.2	
	Illinois	7.2	
	Georgia	7.0	
	Vermont	7.0	
	Maine	6.9	
	South Carolina	6.8	
	Florida	6.7	
	Virginia	6.7	
	Oklahoma	6.6	
	Minnesota	6.6	
	Missouri	6.5	
	Texas	6.5	
	Nebraska	6.5	
	Idaho	6.4	
	Montana	6.2	
	West Virginia	6.1	
	Wisconsin	6.1	
	New Jersey	6.1	
	Iowa	6.0	
	North Dakota	5.9	
	Alaska	5.8	
	Indiana	5.8	
	Ohio	5.6	
	Kansas	5.5	
	South Dakota	5.1	
	Wyoming	4.9	
Greatest Access	Delaware	4.8	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 57

CD-ROM Intensity

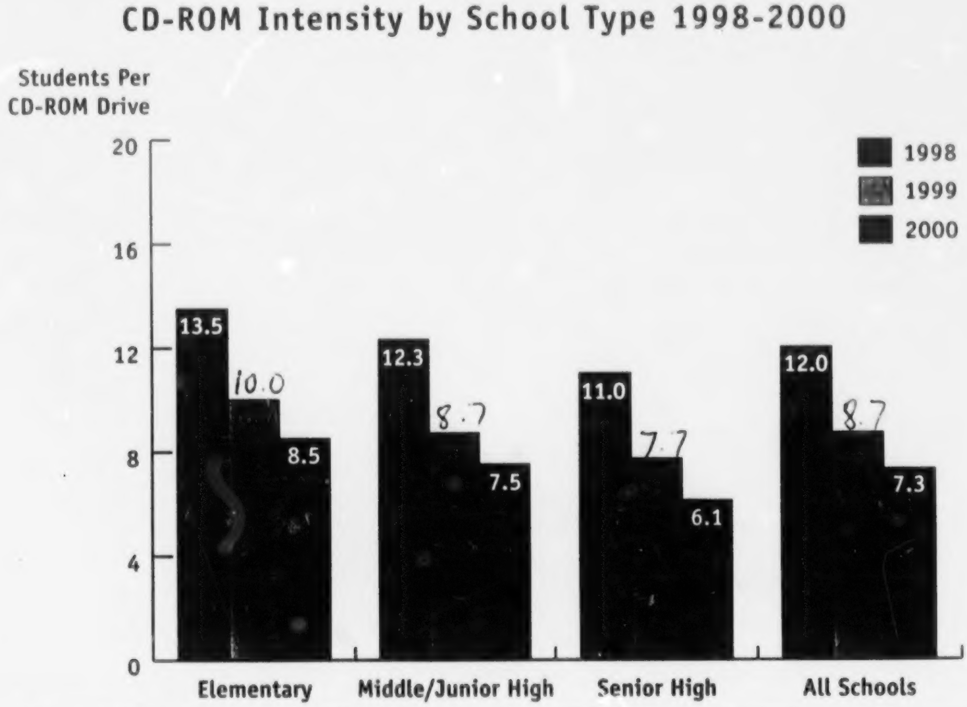


BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

CD-ROM intensity varies somewhat by school type, as can be seen in Figure 58. Senior high schools have the best CD-ROM intensity within the traditional K-12 setting, 6.1 students per CD-ROM drive, followed by middle/junior high schools at 7.5 and elementary schools at 8.5.

Figure 58



Source: Market Data Retrieval, 2000, Public School Findings.

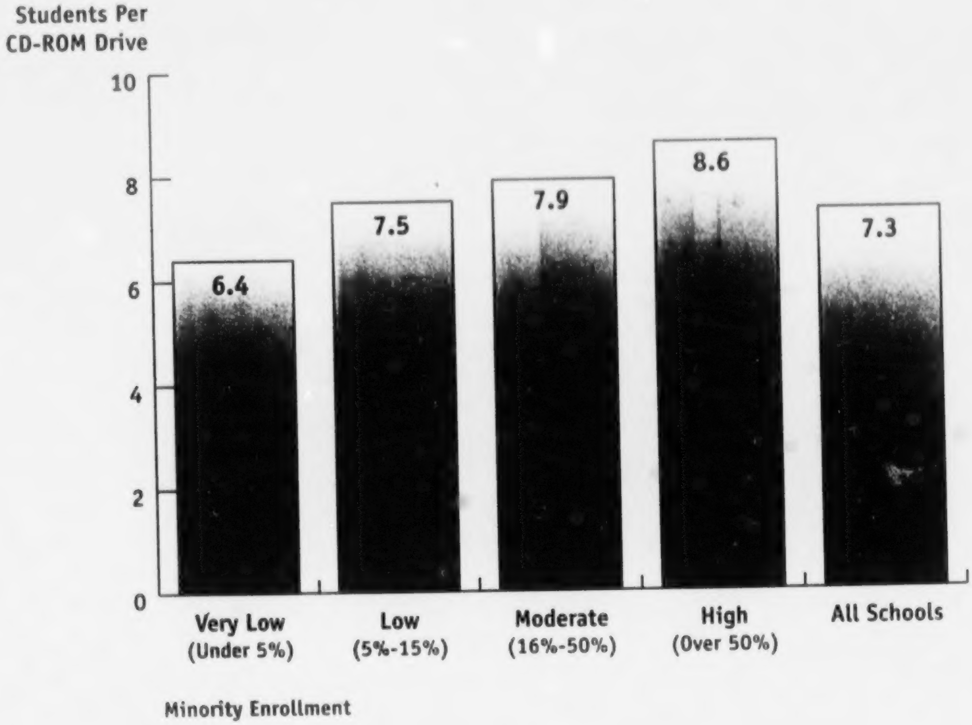
BEST COPY AVAILABLE

Minority Enrollment

Students in schools with high percentages of minority students have more limited access to CD-ROM drives. Schools with minority enrollments over 50% have a CD-ROM intensity of 8.6 students per CD-ROM drive compared to 6.4 for schools with fewer than 5% minority enrollments. Thus schools with high percentages of minority students have less favorable CD-ROM intensities than the national average of 7.3 students per CD-ROM drive. They compare even less favorably to schools with low minority enrollments.

Figure 59

CD-ROM Intensity by Minority Enrollment



Source: Market Data Retrieval, 2000, Public School Findings.

Platforms/CD-ROM Towers

Of the schools that indicate the type of platforms on which their CD-ROM drives are being used, 78% are using Windows, 61% are using Macintosh, and 11% are using MS-DOS. Forty-eight percent of respondents indicate that they use multi-drive CD-ROM towers compared to 40% of schools in 1999, representing a 20% increase overall. (See Table 51.)

Over 90% of senior high schools and more than 80% of middle/junior high schools use CD-ROMs on Windows-based computers. Windows is also the platform of choice among combined schools and adult/special/voc. ed. schools. Apple's traditional strength in the elementary school market is reflected in the fact that elementary schools are nearly as likely to be using CD-ROMs on the Macintosh platform (65%) as on Windows (72%).

Use of CD-ROM towers increases with grade level. While 43% of elementary schools report owning CD-ROM towers, 59% of senior high schools own towers.

Table 51

Schools With CD-ROM Drives by Platform[1]

School Type	Macintosh (%)	MS-DOS (%)	Windows (%)	Multi-Drive Towers (%)
Elementary	64.6	10.4	71.5	43.4
Middle/Junior High	60.5	12.1	81.9	55.0
Senior High	53.4	11.9	93.0	58.9
Combined	49.8	9.6	89.5	51.2
Adult/Special/Voc. Ed.	47.8	8.8	84.9	41.8
Total	**60.9**	**10.8**	**77.9**	**48.1**

[1] Based on respondents who indicated platform type.

Source: Market Data Retrieval, 2000, Public School Findings.

Locations Within Buildings

As is true for instructional computers, schools also report placing their CD-ROM-equipped computers in a variety of locations. Ninety percent of schools indicate that they placed at least some CD-ROM drives in classrooms, 79% in libraries/media centers, and 76% in computer labs. Thirty-eight percent report placing CD-ROM-equipped computers in other locations.

Classroom placement continues to outpace both library/media center and computer lab placement. The CD-ROM has come to be seen as an integral part of the computer. Rapidly declining computer prices have allowed schools to deploy CD-ROM technology as a tool for individual use, with students having access to either content-oriented multimedia applications or various reference-based CD-ROMs. Multiple placement allows students to access CD-ROMs where needed, though there is still need for improvement in the ratio of students to CD-ROM drives.

Table 52

Schools by Location of CD-ROM Drives[1]

Location	Schools (%)
Classroom	90.2
Library	79.0
Computer Lab	75.8
Other	38.3

[1] Based on respondents who indicated location.

Source: Market Data Retrieval, 2000, Public School Findings.

DVD Drives

Over the past year, an increasing number of vendors have begun to offer DVD drives as a standard feature on their high-end computers. While still more expensive than the more traditional CD-ROM drive, DVD technology is beginning to be quite common in the corporate market and seeing increased penetration among consumers. Have the schools begun the transition to DVD technology? It appears only in very small numbers at present.

Roughly 5% of schools report owning PCs equipped with DVD drives. The percentage of schools that own DVD drives ranges from a high of 13% in North and South Dakota to virtually no schools in Delaware.

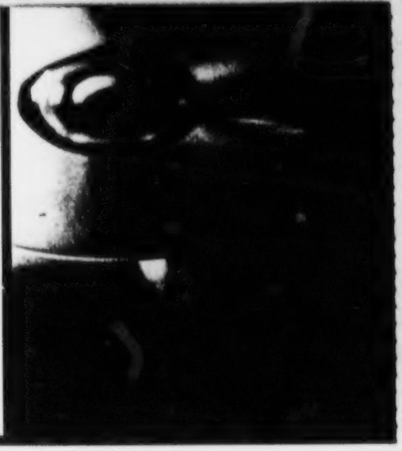
Not surprisingly for a new and somewhat expensive technology, senior high schools are the most likely users. Twice as many senior high schools (8%) report owning DVDs as do elementary schools (4%). Middle/junior high schools fall in the middle, with 6% reporting the presence of DVDs.

Table 53

Schools With DVD Drives by School Type

School Type	Schools (%)
Elementary	3.5
Middle/Junior High	5.6
Senior High	7.9
Combined	7.9
Adult/Spec/Voc. Ed.	6.1
Total	**4.8**

Source: Market Data Retrieval, 2000. Public School Findings.



Videodisc Player Use

While videodisc technology still fills important niches in education and training, it is fading very quickly as an entertainment format, replaced by the digital versatile disc (DVD).

But schools are slow to part with useful equipment. For one thing, equipped with a barcode reader, the videodisc can function as a random-access video presentation device. Because this does not involve the use of a computer and can deliver high-quality visuals to support lectures, such use is likely to persist. Existing players and discs can be expected to be in use for a very long time. There are over 9,000 videodisc titles in the U.S., many of them aimed at the education market. It will take DVD several years to reach this level, and even then, it is likely that a number of titles that exist in videodisc format may not appear on DVD for a long while, if ever.

With Pioneer's mid-1999 decision to discontinue manufacturing of videodisc players, the market cannot expand much beyond its current size. Vendors once strongly identified with the videodisc software market have moved to expand their options, delivering content in multiple, digital formats, including DVD. For example, Optical Data's *Total Class* product line allows classroom teachers to quickly access full-frame, full-motion video-enhanced lessons from a classroom computer. The content can be delivered via CD-ROM, DVD-ROM, LAN, or WAN and displayed on a standard television or monitor. As Internet bandwidth increases, streaming video technology will deliver digital video directly to the desktop or to video servers that will allow teachers to call up short video clips that illustrate and support their lessons.

Videodisc – User Profile

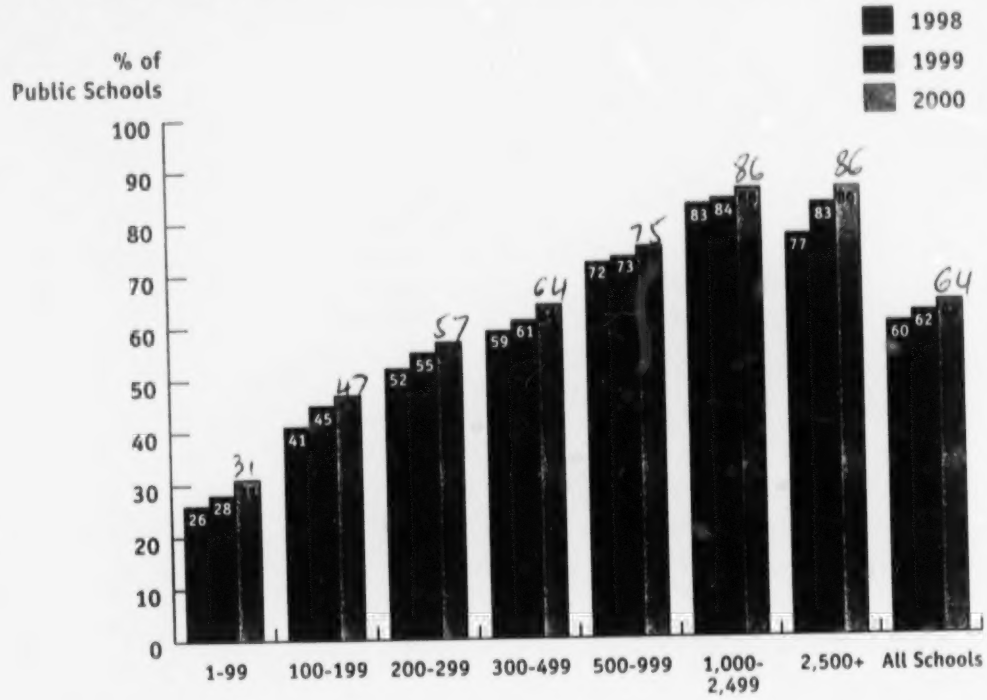
- Middle/junior high
- Large (more than 1,000 students)
- Low poverty-level enrollments (under 6%)

National and State Penetration Levels

The penetration of videodisc players has slowed significantly. In the period from 1998 to 2000, videodisc player penetration increased 7%, from 60% of all public schools in 1998 to 64% in 2000. A similar pattern held for videodisc penetration within each of the public school enrollment categories, though growth rates are higher among smaller schools (under 300 students) and very large schools (2,500+ students), as can be seen in Figure 60.

Figure 60

Videodisc Player Penetration by School Enrollment 1998-2000



Source: Market Data Retrieval, 2000, Public School Findings.

Nationwide, 64% of all public schools have videodisc players. Penetration varies by state, ranging from a high of 90% in Florida to a low of 30% in Vermont. (See Table 54 and Figure 61.) Among the states with high videodisc penetration percentages are Florida (90%), Texas (77%), and California (68%). These three states have actively supported the development of multimedia products that incorporate videodisc material, such as Knowledge Adventure's *Vital Links*. California was also involved in the development of Decision Development Corp.'s *Science 2000* product, which incorporates videodiscs, software, worksheets, and hands-on manipulative science kits. Florida funded some of the first videodisc development specifically for education in the early 1990s and offered each school funds to purchase a videodisc player. And, in 1990, Texas was the site of the groundbreaking elementary science adoption of Optical Data's *Windows on Science*, the first statewide adoption of electronic media in a basal textbook adoption.

Table 54

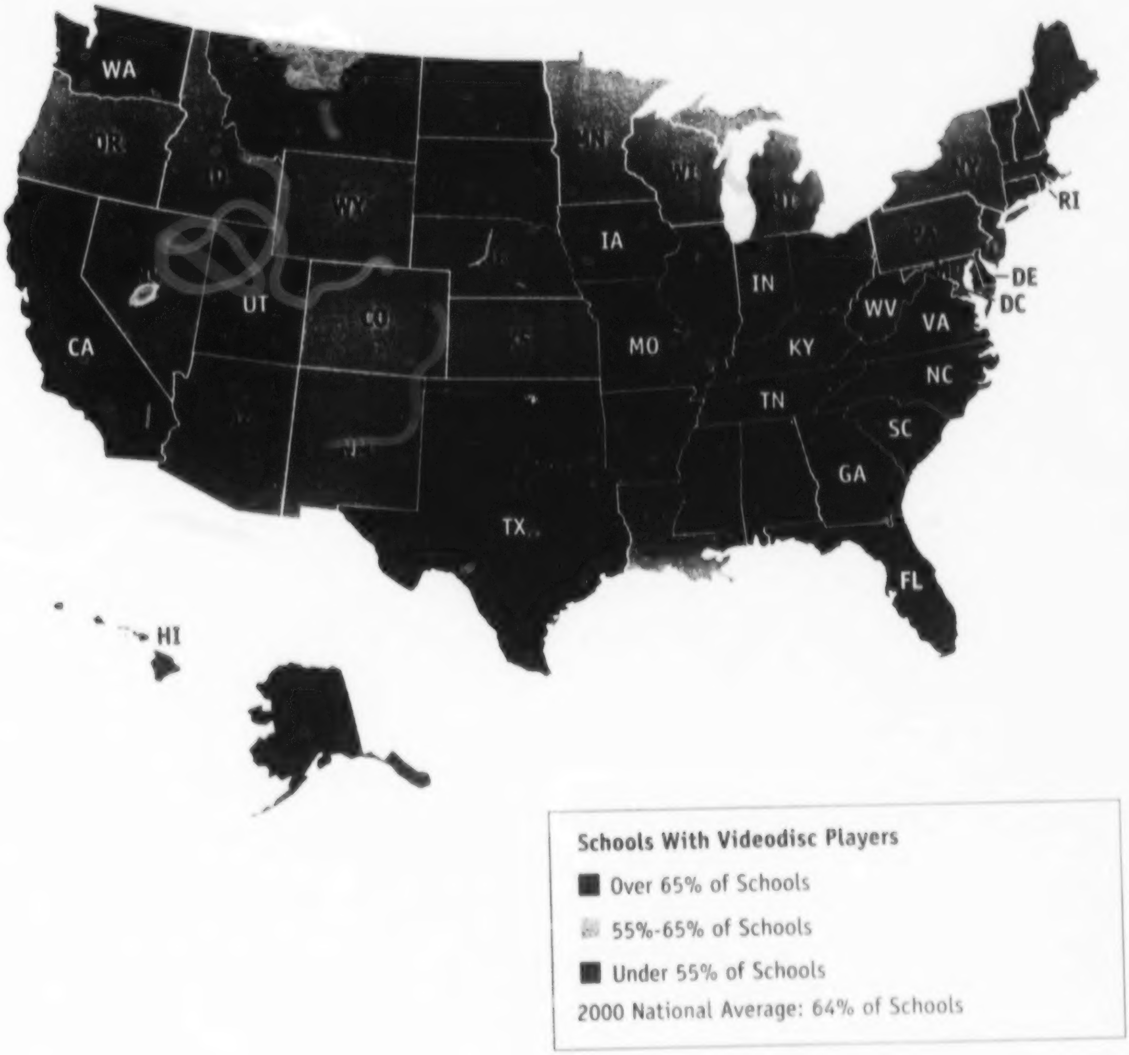
Schools With Videodisc Players

State	School Penetration (%)	
Florida	89.8	
Tennessee	84.9	
Virginia	81.2	
Utah	79.7	
North Carolina	79.1	
West Virginia	78.6	
Texas	76.5	
South Carolina	74.0	
Indiana	73.3	
Hawaii	71.1	
Georgia	70.9	
Washington	69.1	
Missouri	69.0	
California	68.0	
Kentucky	68.0	
Delaware	66.7	
Iowa	66.6	
Wisconsin	65.1	
Wyoming	64.9	
Kansas	64.5	
Nebraska	64.2	*National Average 64.0%*
Arizona	63.2	
Colorado	62.0	
Minnesota	61.8	
Maryland	60.8	
New Jersey	59.7	
New York	59.3	
Michigan	57.4	
Oregon	56.7	
Pennsylvania	56.4	
New Mexico	56.2	
Louisiana	55.3	
Idaho	55.2	
Nevada	54.9	
Arkansas	54.4	
Connecticut	54.0	
Ohio	52.3	
Alabama	52.0	
Illinois	52.0	
Massachusetts	48.4	
New Hampshire	47.7	
Mississippi	47.5	
Alaska	46.7	
Oklahoma	45.3	
South Dakota	45.0	
North Dakota	43.8	
Rhode Island	43.4	
Montana	42.0	
District of Columbia	41.2	
Maine	34.8	
Vermont	30.1	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 61

Schools With Videodisc Players



BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

School Type vs. School Enrollment

School size has a strong effect on videodisc player penetration, with videodisc ownership rising steadily as school size increases. More than 85% of the largest schools (1,000 or more students) own videodisc players compared to only 31% of the smallest schools (under 100 students).

School type is also related to the percentage of videodisc player penetration, with penetration increasing as grade level rises. Middle/junior high schools report the highest percentage penetration (80%) for videodisc players, with senior high schools at 71% and elementary schools lagging at 60%. Combined schools report penetration percentages of 56%. The adult/special/voc. ed. schools have the lowest videodisc player penetration rate, 41%.

Much of the existing videodisc content targets middle/junior and senior high school students. Further, students at these grade levels are more likely to be taught in large classes in which the videodisc can be effectively used to support a lecture-style presentation.

Table 55 illustrates the relationship between school type and enrollment size and videodisc player penetration. Videodisc ownership increases with school size. Within each enrollment category, middle/junior high schools generally display the highest penetration rates, followed by senior high, elementary, combined, and adult/special/voc. ed. schools.

Table 55

Videodisc Penetration: School Type by School Enrollment

School Type	All Schools (%)	1-99 (%)	100-199 (%)	200-299 (%)	300-499 (%)	500-999 (%)	1,000-2,499 (%)	2,500+ (%)
Elementary	60.2	29.3	43.8	52.4	60.7	72.3	78.6	100.0
Middle/Junior High	79.8	50.9	62.1	71.1	73.6	83.8	91.7	100.0
Senior High	70.8	33.5	55.5	65.5	74.1	78.1	87.5	91.5
Combined	55.5	29.0	46.1	69.9	65.5	74.3	70.6	100.0
Adult/Special/Voc. Ed.	41.2	32.1	35.7	50.0	50.5	48.8	34.4	44.4
Total	**64.0**	**31.3**	**46.9**	**57.2**	**63.5**	**75.2**	**85.5**	**85.9**

Source: Market Data Retrieval, 2000, Public School Findings.

Poverty Level

Poverty level indicates the percentage of children below the poverty line in the district. The higher a district's poverty level, the poorer the community it serves.

Schools in districts with higher percentages of poverty (30% or higher) report lower percentages of videodisc player penetration. While 69% of schools with lower poverty levels (below 6%) own videodisc players, 59% of schools with 30% or higher poverty-level enrollments do so. Within each poverty-level category, middle/junior high schools remain the most likely to report videodisc player ownership. (See Table 56.)

Table 56

Videodisc Penetration: School Type by Poverty Level

School Type	All Schools (%)	0%-5.9% (%)	6%-15.9% (%)	16%-29.9% (%)	30%+ (%)
Elementary	60.2	64.2	60.8	60.2	56.1
Middle/Junior High	79.8	84.5	80.9	78.7	74.6
Senior High	70.8	78.0	73.4	69.7	64.5
Combined	55.5	53.1	59.2	55.5	51.9
Adult/Special/Voc. Ed.	41.2	41.4	32.1	42.3	38.1
Total	**64.0**	**68.7**	**65.4**	**63.7**	**58.9**

Source: Market Data Retrieval, 2000, Public School Findings.

Media Retrieval Systems

Media retrieval systems allow schools to distribute media content, including videotapes, videodiscs, cable, and broadcast video feeds, from a centralized location to classrooms throughout the building. Once a piece of media is scheduled, it comes directly to the classroom TV at the time requested.

Twenty percent of schools report using a media retrieval system. Media retrieval system penetration varies from a high of 40% in South Carolina to a low of 3% in Maine. Only ten states report that 25% or more of their schools own media retrieval systems. (See Table 58 and Figure 62.)

School Type vs. School Enrollment

School size has a strong effect on media retrieval system penetration, with ownership rising steadily as school size increases. Roughly 30% of the largest schools (1,000 or more students) own media retrieval systems compared to only 9% of the smallest schools (under 100 students).

School type is also related to the percentage of media retrieval system penetration, with penetration increasing as grade level rises. Middle/junior high schools report the highest penetration (25%), with senior high schools at 23% and elementary schools following at 18%. Combined schools report penetration percentages of 19%. The adult/special/voc. ed. schools have the lowest media retrieval system penetration rate, 12%.

Table 58 illustrates the relationship between school type and enrollment size and media retrieval system penetration. Media retrieval system ownership increases with school size. Within each enrollment category, middle/junior high schools generally display the highest penetration rates, followed by senior high, combined, and elementary schools.

Table 57

Media Retrieval System Penetration: School Type by School Enrollment

School Type	All Schools (%)	1-99 (%)	100-199 (%)	200-299 (%)	300-499 (%)	500-999 (%)	1,000-2,499 (%)	2,500+ (%)
Elementary	17.5	8.8	12.0	13.6	17.5	21.9	25.9	100.0
Middle/Junior High	25.1	11.3	17.1	17.7	22.7	27.2	31.3	100.0
Senior High	23.4	11.1	11.9	19.8	24.0	26.3	32.4	28.8
Combined	19.4	7.9	18.0	23.1	23.8	27.1	29.4	-
Adult/Special/Voc. Ed.	12.4	7.4	16.3	9.2	17.8	13.8	12.5	11.1
Total	**19.6**	**9.2**	**13.1**	**15.4**	**19.0**	**23.6**	**30.4**	**28.2**

Source: Market Data Retrieval, 2000, Public School Findings.

Table 58

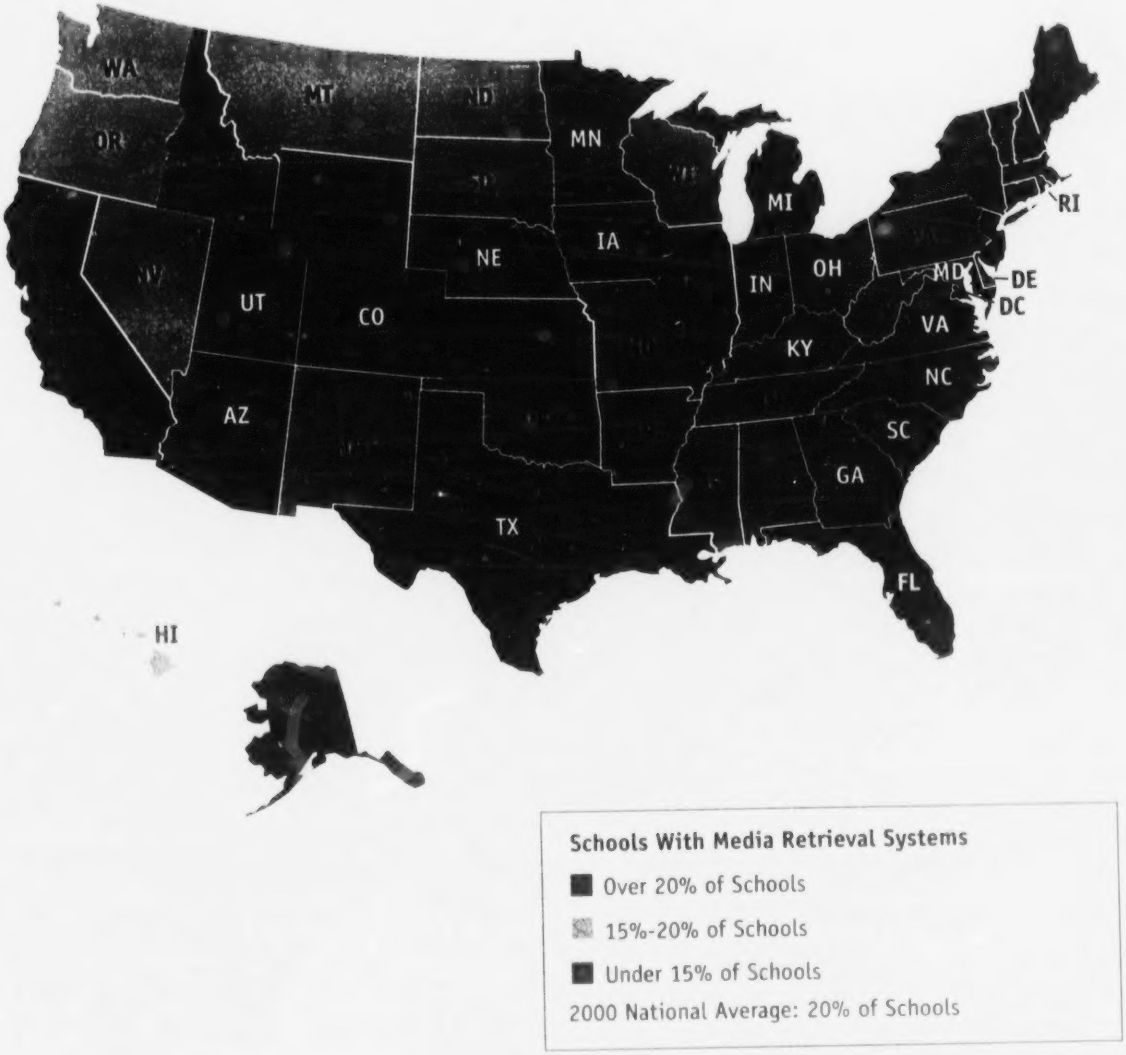
Schools With Media Retrieval Systems

State	School Penetration (%)	
South Carolina	39.6	
Georgia	38.9	
Florida	36.0	
Minnesota	30.4	
Utah	30.2	
Kentucky	29.2	
North Carolina	28.3	
Virginia	25.9	
Arizona	24.8	
Maryland	24.6	
Nebraska	24.4	
District of Columbia	23.5	
Indiana	23.1	
Michigan	20.9	
Iowa	20.1	
Texas	19.7	
Ohio	19.7	
Colorado	19.6	*National Average 19.6%*
Alabama	19.1	
Delaware	19.0	
North Dakota	19.0	
West Virginia	18.2	
Missouri	18.0	
Wisconsin	17.9	
Washington	17.8	
Hawaii	17.8	
Arkansas	17.7	
Tennessee	17.7	
Nevada	17.6	
South Dakota	17.6	
Oregon	17.1	
Mississippi	16.6	
Pennsylvania	16.0	
Montana	15.4	
Oklahoma	15.2	
New Mexico	15.0	
New Jersey	14.4	
Wyoming	14.3	
Connecticut	14.1	
Kansas	14.1	
Louisiana	14.0	
Idaho	12.4	
Illinois	11.6	
California	11.2	
New York	10.8	
Massachusetts	10.7	
New Hampshire	10.1	
Alaska	10.0	
Rhode Island	9.4	
Vermont	7.2	
Maine	3.2	

Source: Market Data Retrieval, 2000, Public School Findings.

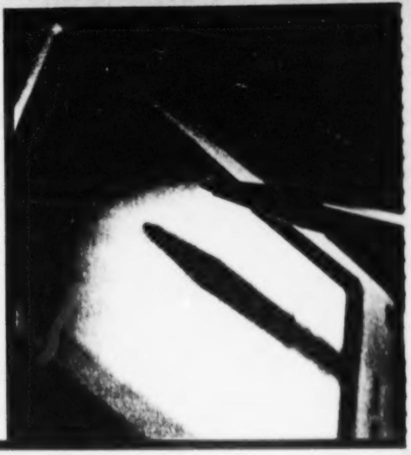
Figure 62

Schools With Media Retrieval Systems



BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.



Teacher Skill Level and Professional Development

Technology-related professional development continues to top the list of concerns and to be the focus of numerous initiatives at both the federal and state government levels. Professional development is considered by many to be the key to the effective use of technology to improve student learning.

Ultimately, educational technology is not about technology. It's about what teachers and students are doing with technology to extend their knowledge and understanding of the world around them. Technology adds a powerful tool to teachers' repertoires, expanding their ability to meet the individual learning needs of all students. But this is only true if teachers know how to use that tool effectively.

Professional development has been the focus of several school-community partnerships announced over the past year, including a major initiative from Intel and programs from the BellSouth Foundation. *Intel Teach to the Future* is a worldwide initiative to train more than 400,000 classroom teachers in 20 countries to effectively use computer technology to improve student learning. Over the next three years, Intel will invest $100 million in cash, equipment, curriculum development, and program management to deliver its train-the-trainer model. *BellSouth edu.pwr3* works at all levels within a district to develop leaders, train teachers, and help students learn how to apply technology to classroom teaching and learning. The program includes leadership seminars directed to superintendents and professional development grants that will support training a minimum of 65% of the teachers at each grant site. BellSouth is also partnering with the Consortium for School Networking (CoSN) to train school technology specialists.

Technology vendors have expanded their efforts to market professional development services to the K-12 market over the past two years. Schools can now choose from a broadened range of programs offered in a wide variety of formats. Educational Resources has fielded an on-demand training model, using digital satellite technology to deliver compressed video and data files containing training modules to schools. The data, stored on a content server connected to the school LAN, can then be called up to teacher's individual workstations or accessed from home via a dial-up connection. Classroom Connect's *Connected University* is a Web-delivered service offering 30 different professional development courses, as well as a library of learning resources, "just-in-time" tutorials, and online forums. T.H.E. Institute and Knowvation, Inc., recently joined forces to expand their capabilities for professional development, offering options that include on-site workshops, online, site-to-Web hybrids, and CD-ROM/intranet formats.

One of the ongoing frustrations of the schools has been the perceived failure of the pre-service system to prepare new teachers to use technology effectively in the classroom environment. Faced with the potential influx of two million new teachers by the year 2008, this frustration could develop into an overwhelming problem. MDR conducted a research study in April 1999 to determine how prepared new teachers believed they were to implement technology in the classroom. According to the survey findings, published in the *New Teachers and Technology 1999* report, roughly half of first- and second-year teachers said that their college experience left them "somewhat prepared" to integrate technology into classroom instruction. Less than 40% of the MDR sample indicated that they either feel "very well prepared" (13%) or "well prepared" (26%) to integrate technology into their classrooms. However, a majority of teachers who received more than 10 hours of training in the past 12 months said they feel either "very well prepared" (21%) or "well prepared" (33%) to integrate technology into their classrooms.

To address this problem, the Clinton Administration's Preparing Tomorrow's Teachers program awarded 225 consortium grants to support implementation and infusion of technology into the preparation and field experiences of 400,000 future teachers. The most recent round of funding committed $45 million to support partnerships between teacher colleges, elementary and secondary schools, community-based organizations, and high-tech companies to ensure that all new teachers can use technology effectively to improve student performance. The federal grants will be matched by over $130 million in private investment.

Technology is a powerful tool for overall school improvement and improved teaching and learning. School districts have also been able to leverage federal funds from the Technology Literacy Challenge Fund Grant with support from the Eisenhower Professional Development Program and Goals 2000 state and local grants to align their teacher training programs with rigorous content and performance standards. The focus of professional development activities is on improving student performance through the integration of technology into the curriculum. But learning to use technology effectively takes time and effort. Teachers need models of how technology can enhance learning opportunities. They need time to internalize those models and put them into practice. They need opportunities to collaborate with fellow teachers—to plan together, share best practices, and develop new skills. And they need ongoing support while they experiment with ways of integrating technology into their existing curriculum.

Daily Use of Computers

One measure of progress with technology can be found in the number of teachers who use it regularly. Schools were asked to report the percentage of teachers who use a computer on a daily basis for instructional planning and/or teaching. (See Table 59 and Figure 63.) Seventy-six percent of public schools indicate that the majority (50%+) of their teachers use computers daily versus 69% in 1999, representing a 10% increase. The degree of use varies by state. In Alaska, Rhode Island, and Iowa over 90% of responding schools report that the majority of their teachers use computers daily for instructional purposes. Fifty percent of the schools in the District of Columbia indicate that the majority of their teachers use computers daily.

Table 59

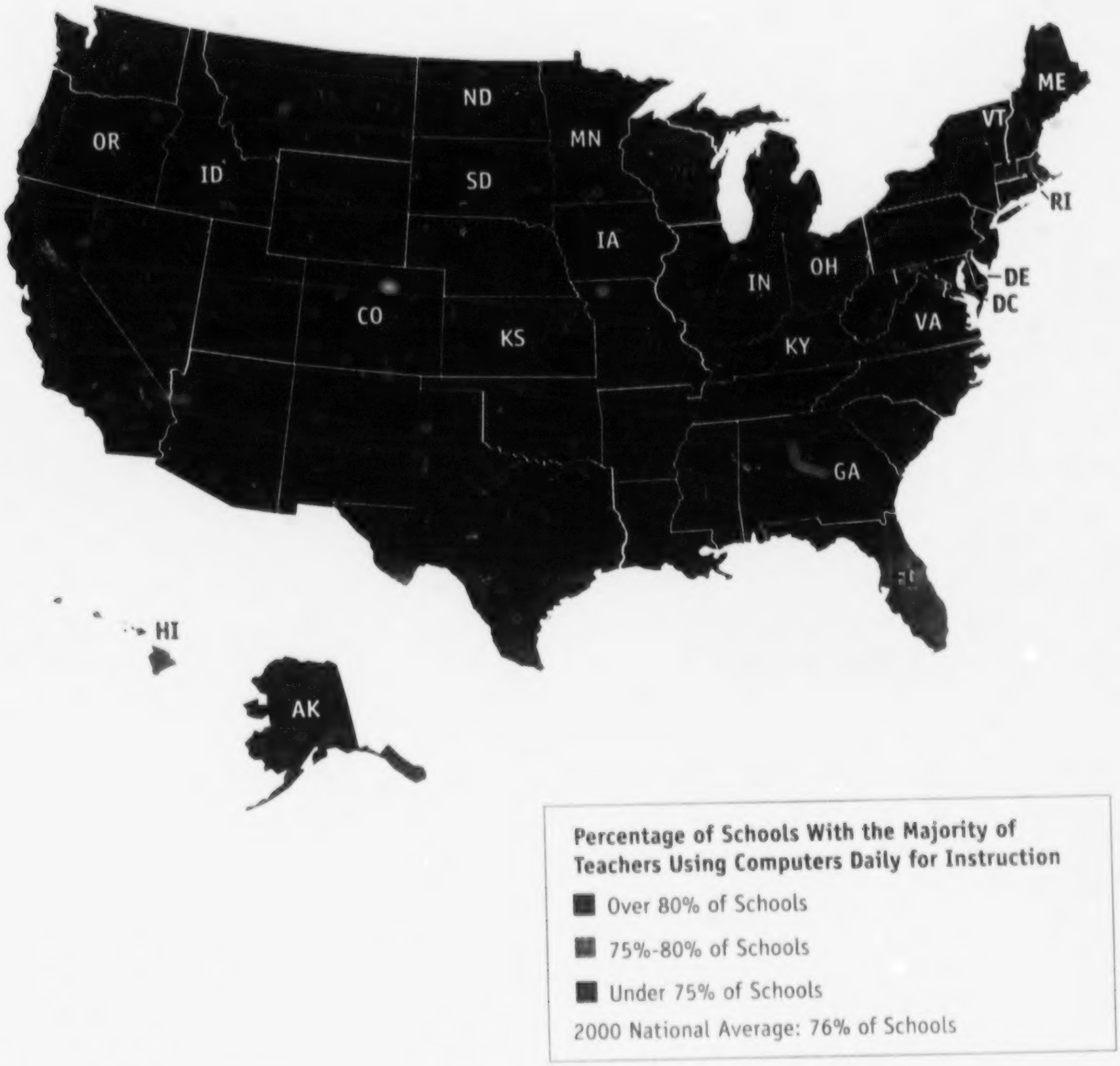
Teachers Using Computers Daily

State	School Penetration (%)	
Alaska	91.7	
Rhode Island	91.3	
Iowa	91.2	
Colorado	88.7	
Indiana	86.6	
Kansas	86.3	
Oregon	84.9	
Idaho	84.2	
Minnesota	84.2	
Georgia	84.2	
Virginia	83.9	
Kentucky	83.8	
Ohio	83.0	
Vermont	82.1	
Maine	81.3	
North Dakota	81.1	
South Dakota	81.0	
South Carolina	80.9	
Florida	80.2	
Tennessee	80.2	
West Virginia	79.7	
Texas	79.5	
Hawaii	78.9	
Utah	78.4	
Nevada	77.8	
Massachusetts	77.5	
Missouri	77.3	
Washington	76.4	
Wyoming	76.2	*National Average 76.2%*
North Carolina	75.8	
Nebraska	75.5	
Wisconsin	75.4	
Montana	74.5	
New Mexico	73.7	
Louisiana	72.5	
Michigan	71.9	
Delaware	71.8	
Connecticut	71.7	
Arkansas	71.0	
Illinois	69.7	
Alabama	69.4	
Pennsylvania	69.3	
New York	68.6	
New Jersey	67.9	
Arizona	67.5	
California	66.2	
Mississippi	64.3	
Maryland	63.5	
Oklahoma	62.0	
New Hampshire	53.6	
District of Columbia	50.0	

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 63

Teachers Using Computers Daily


ND
OR
MN
ID
SD
IA
OH
IN
CO
KS
KY
VA
GA
ME
VT
RI
DE
DC
HI
AK
Percentage of Schools With the Majority of Teachers Using Computers Daily for Instruction
■ Over 80% of Schools
■ 75%-80% of Schools
■ Under 75% of Schools
2000 National Average: 76% of Schools

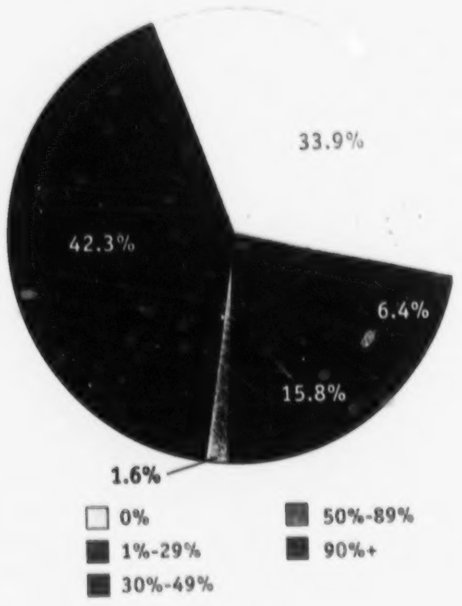
BEST COPY AVAILABLE

Source: Market Data Retrieval, 2000, Public School Findings.

Sixteen percent of schools report that between 1% to 29% of their teachers use computers daily and 6% say between 30% to 49% do so. Only 2% of schools report that none of their teachers use computers on a daily basis. Forty-two percent of schools, up from 37% the year before, report that virtually all (90% or more) of their teachers use computers daily for instructional purposes.

Figure 64

Schools by Percentage of Teachers Using Computers Daily



Should be read as: In 42.3% of all the schools, 90% or more of the teachers are using computers daily.

Source: Market Data Retrieval, 2000. Public School Findings.

Technology-Use Skill Level

Survey respondents were asked to estimate the percentage of their teachers at each of four technology-use skill levels: Beginner (learning basics), Intermediate (uses variety of applications), Advanced (uses in curriculum), or Innovator/Instructor (leader/instructs others).

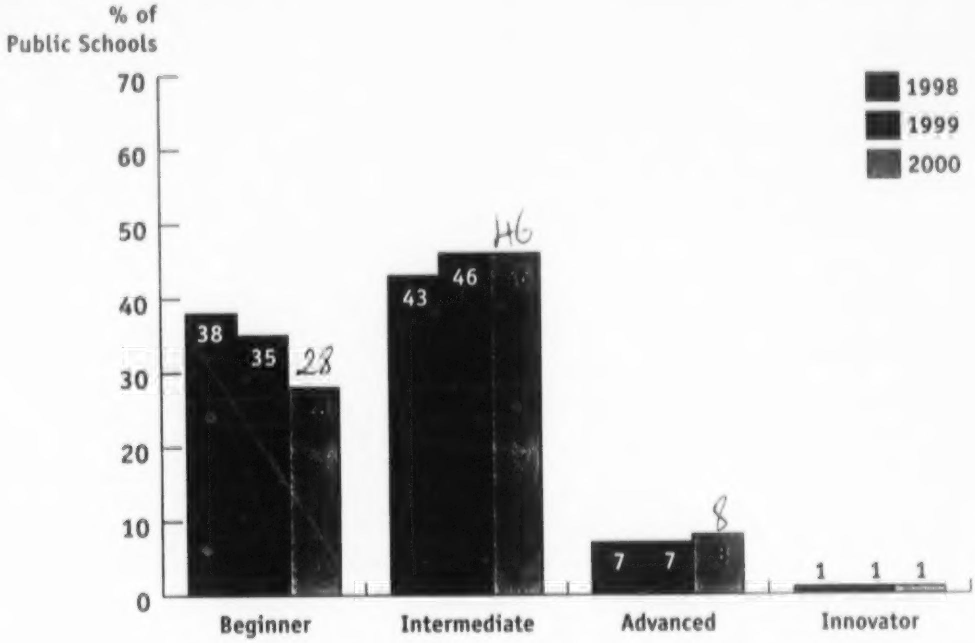
The largest percentage of schools (46%) report that the majority of their teachers (50% or more) could be identified at the Intermediate skill level. (See Figure 65.) These teachers are able to use a variety of computer applications, such as word processors, and individual CD-ROM applications, such as interactive encyclopedias. Though there has been no change in the percentage of schools reporting that the majority of their teachers are at the Intermediate skill level, the number of schools who placed the majority of their teachers at the Beginner level has decreased significantly. In 2000, 28%

of schools categorize the majority of their teachers as Beginners, as opposed to 35% last year. These teachers are just mastering the basics of computer use. They may still be learning to navigate in Windows or they may be developing facility with one software application.

Eight percent of schools, up from 7% in 1999, say that the majority of their teachers are at an Advanced skill level, able to integrate technology use into the curriculum. And only 1% of schools place the majority of their teachers at the Innovator/Instructor level.

Figure 65

Teachers: Technology-Use Skill Level 1998-2000



Skill level of the majority (50% or higher) of teachers in a school. Not all schools report a majority of teachers in a category.

Source: Market Data Retrieval, 2000, Public School Findings.

It takes time and sustained effort to move up the technology-use skill continuum. Only sustained intervention and ongoing support results in changes that enable effective integration of technology and curriculum. Experience indicates that teachers need on-site and on-demand assistance with the integration of technology into teaching and learning. This is the type of help that teachers at the more advanced skill levels can provide to others. But many more teachers need to achieve these levels before true mentoring is possible.

BEST COPY AVAILABLE

Hours of Technology-Related Professional Development

Survey respondents were asked how many hours of technology-related professional development were offered per year to teachers. On average, schools offer 19 hours of technology-related professional development. The bulk of respondents, 30%, offer between 1 and 9 hours per year. Ten percent of schools report offering 50 hours or more of technology-related professional development annually.

Training-Intensive Schools by School Type and Enrollment

Training-intensive schools are those that provide more than the national average of 19 hours of technology-related professional development on an annual basis. Eight percent of all public schools are training intensive.

The percentage of schools that offer more than 19 hours of technology-related professional development increases as school size increases. Twelve percent or more of the largest schools (1,000 or more students) are training intensive compared to 5% of the smallest schools (fewer than 100 students).

Middle/junior high schools are most likely (10%) to be training intensive, followed by senior high schools (8%) and elementary schools (8%).

Table 60

Training-Intensive Schools: School Type by School Enrollment

School Type	All Schools (%)	1-99 (%)	100-199 (%)	200-299 (%)	300-499 (%)	500-999 (%)	1,000-2,499 (%)	2,500+ (%)
Elementary	7.9	3.9	5.2	7.2	7.3	9.9	13.9	100.0
Middle/Junior High	9.8	1.9	7.1	7.8	9.9	10.4	11.2	-
Senior High	8.4	5.7	8.0	6.9	7.7	8.6	10.5	16.9
Combined	6.7	4.7	7.3	6.4	4.9	10.4	17.6	-
Adult/Special/Voc. Ed.	8.2	7.4	8.2	3.9	8.9	11.3	15.6	-
Total	**8.2**	**4.7**	**6.2**	**7.0**	**7.6**	**9.9**	**11.5**	**15.5**

Source: Market Data Retrieval, 2000, Public School Findings.

Training-Intensive Schools by Poverty Level

Poverty level indicates the percentage of children below the poverty line in the district. The higher a district's poverty level, the poorer the community it serves.

Fewer schools in districts with higher percentages of poverty (30% or higher) are training intensive. While 9% of schools with lower poverty levels (under 6%) are training intensive, 7% of schools with 30% or higher poverty-level enrollments are training intensive. At the middle/junior high school level, 12% of schools with lower poverty levels (under 6%) are training intensive compared to 8% of schools with 30% or higher poverty-level enrollments. Among senior high schools, 10% of schools with low poverty levels (under 6%) are training intensive compared to 8% of schools with 30% or higher poverty-level enrollments. Nine percent of elementary schools with lower poverty levels (under 6%) are training intensive compared to 7% of schools with 30% or higher poverty-level enrollments.

Table 61

Training-Intensive Schools: School Type by Poverty Level

School Type	All Schools (%)	0%-5.9% (%)	6%-15.9% (%)	16%-29.9% (%)	30%+ (%)
Elementary	7.9	9.0	7.9	7.9	6.8
Middle/Junior High	9.8	11.7	10.1	9.8	7.7
Senior High	8.4	9.8	8.5	8.2	8.2
Combined	6.7	4.1	8.5	4.8	8.7
Adult/Special/Voc. Ed.	8.2	6.9	8.6	8.5	1.9
Total	**8.2**	**9.4**	**8.4**	**8.1**	**7.1**

Source: Market Data Retrieval, 2000, Public School Financing

Technology Expenditures

In its *Making the Grade—2000* report, Deutsche Banc Alex. Brown compiled an estimate of 1999 K-12 instructional technology spending that totaled $5.9 billion. The National Center for Education Statistics estimates that total expenditures for K-12 education during the 1998-99 school year were $292 billion. Thus technology spending accounted for 2% of total K-12 educational expenditures. It is always difficult to compare estimates of educational technology expenditures, since estimates often include different categories of spending. For example, the Alex. Brown report includes distance learning and telecommunications expenditures but does not include spending on technology-related professional development.

With expenditures of $5.9 billion, it would appear that there has been a slight improvement from the 1995 study by McKinsey & Company, produced for the National Information Infrastructure Advisory Council, in which it was estimated that schools spent about 1.3% of their budgets on technology. The increase may reflect the impact of the $1.6 billion infusion that resulted from E-rate funding in the 1998-99 period. The McKinsey study also estimated it would cost between 1.5% and 3.9% of the national K-12 budget to connect all schools to the information highway.

Technology Spending

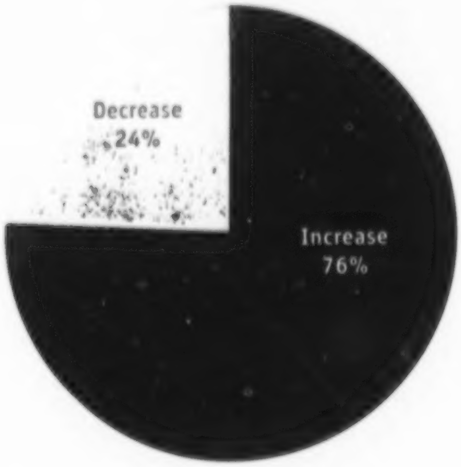
Respondents to MDR's 2000 survey were asked to report how much their school expected to spend on technology in the 1999-00 school year in the categories of hardware, software, and professional development. Schools' estimated technology spending for 1999-00 is $5.67 billion or $121.37 per student, up 2.5% from last year. The National Center for Education Statistics projected that total expenditures for K-12 education during the 1999-00 school year would reach $305 billion. Technology spending in 1999-00 appears to account for roughly 1.8% of total K-12 expenditures.

Expectations for Technology Spending

Respondents were asked to indicate if they expected 1999-00 spending to increase or decrease over the prior year. The vast majority of schools, 76%, expected 1999-00 technology spending to increase.

Figure 66

Expectations for Technology Spending[1]



[1] Reflects expectations for 1999-2000 school year.

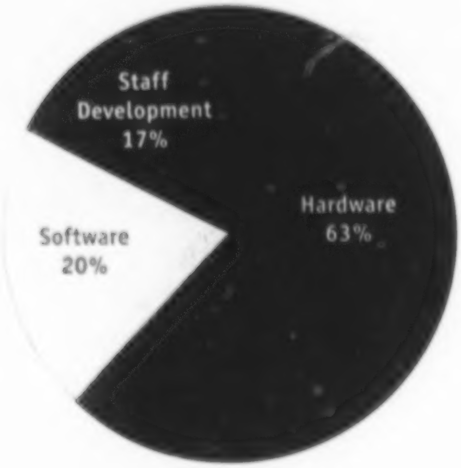
Source: Market Data Retrieval, 2000, Public School Findings.

Technology Spending by Category

Not surprisingly in a system still struggling to give all students reasonable access to state-of-the-art computers, the bulk of technology spending is directed to hardware, accounting for 63% of total technology spending. Schools expect to spend 20% of their technology budgets on software and 17% on staff development. It appears that schools shifted more of their budgets during 1999-00 to both software and staff development, up from 17% and 14%, respectively, from 1998-99 levels.

Figure 67

Technology Spending



Source: Market Data Retrieval, 2000, Public School Findings.

Looked at in another way, of the $121.37 per pupil spent on technology, $76.58 per pupil is spent on hardware, $24.40 on software, and $20.39 on staff development.

Table 62

Technology Spending[1]

	Per Pupil ($)	Total (In Millions) ($)
Hardware	76.58	3,578
Software	24.40	1,140
Staff Development	20.39	953
Total	**121.37**	**5,671**

[1] Total projected spending.

Source: Market Data Retrieval, 2000, Public School Findings.

Technology Sophistication Index™ (TSI)

Market Data Retrieval has collected information on the use of technology in schools ever since the personal computer first arrived on the scene in the early 1980s. In 2000 MDR developed and introduced a new measure for examining technology and its presence in the school market. The Technology Sophistication Index (TSI) is a measure of the overall technology infrastructure of a school relative to the number of students in that school.

TSI was created using a computer-scoring process that incorporated a wealth of MDR's school-level technology information and other demographic data, such as enrollment. Ultimately, a numeric score is assigned to all schools, and the schools are then placed into one of five categories spanning from high to low. Many variables are included in a school's overall ranking:

- Number of instructional computers
- Number of multimedia computers
- Number of high-end computers (486 and higher)
- Speed of Internet access
- Number of CD-ROM drives

TSI was designed to go beyond just inventory numbers. In addition to incorporating the technologies in a school, TSI factors in the number of students having access to the technologies. The process also included other ratios, such as the number of high-end computers to total number of instructional computers.

High TSI schools tend to have attractive computer intensity ratios, attractive multimedia computer intensity ratios, high-speed Internet access, a high number of classrooms with Internet access, and a lower number of students. The Medium and Low TSI schools tend to have less attractive ratios and larger student bodies.

This final chapter will focus on findings related to TSI as applied to the schools that responded to this year's survey. This section contrasts schools with attractive technology profiles (High TSI schools) to those with average profiles (Medium TSI schools) and to those with much less attractive profiles (Low TSI schools).

TSI Overview

Given the variables that contribute to creating a school's TSI score, it is not surprising to find that, in general, High TSI schools have a high number of modern computers in place and report high penetrations of other technologies, such as networks, the Internet, CD-ROM, and satellite. They tend to be smaller than the schools making up the other TSI categories and, on a more revealing note, have significantly fewer poor and minority students enrolled.

Medium TSI schools are more like the bulk of all-American public schools, of a moderate size with moderately diverse student bodies. They also have a significant number of modern computers in place and report moderately high penetrations of most other technologies. However, they tend to be larger than the High TSI schools, and therefore, the access to technology that they are able to afford their students is somewhat lower.

Low TSI schools not only have fewer computers in place, they have a higher proportion of older computers among their installed base. They report lower penetrations for most technologies and tend to be large enrollment schools. Evidence of a digital divide again surfaces as these schools have a significant number of poor and minority children among their student body.

Demographic Characteristics

Examining the demographic characteristics of the responding schools in each of the three TSI categories helps fill in the picture of what these schools look like.

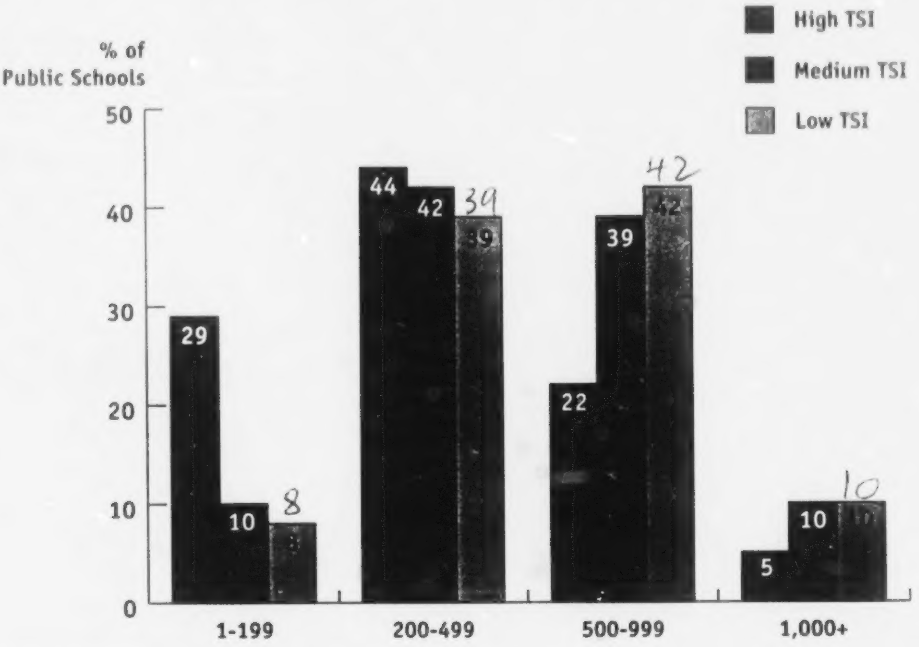
Enrollment

Low enrollments are a hallmark of High TSI schools. (See Figure 68.) Twenty-nine percent of High TSI schools enroll fewer than 200 students compared to 10% of Medium TSI schools and 8% of Low TSI schools. Nearly three out of four High TSI schools have fewer than 500 students enrolled. Roughly half of the Medium and Low TSI schools have fewer than 500 students. Medium and Low TSI schools are twice as likely as High TSI schools to have enrollments of 1,000 or more students.

School Type

Elementary schools account for the largest percentage of schools in each of the TSI categories. (See Figure 69.) As mentioned above, High TSI schools tend to have low enrollments; however, it is interesting to note that senior high schools, which typically have large enrollments, make up 29% of High TSI schools. High TSI schools are twice as likely as Medium TSI schools and nearly three times as likely as Low TSI schools to be senior high schools. Elementary schools account for a disproportionate percentage of Low TSI schools, nearly 75%. This confirms that senior high schools tend to be more technology rich than elementary schools.

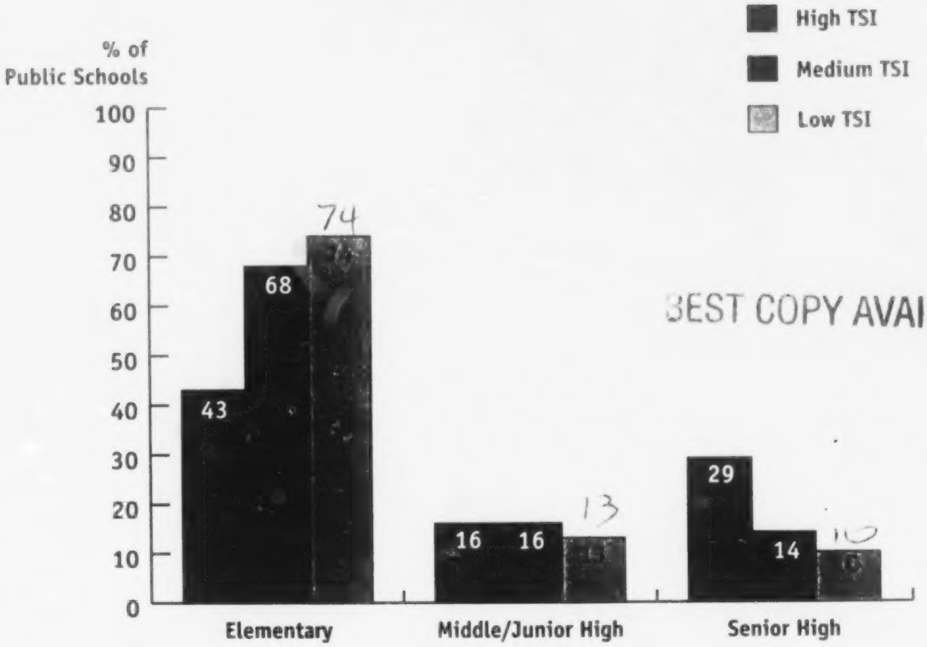
Figure 68



TSI by Enrollment

Source: Market Data Retrieval, 2000, Public School Findings.

Figure 69



TSI by School Type

BEST COPY AVAILABLE

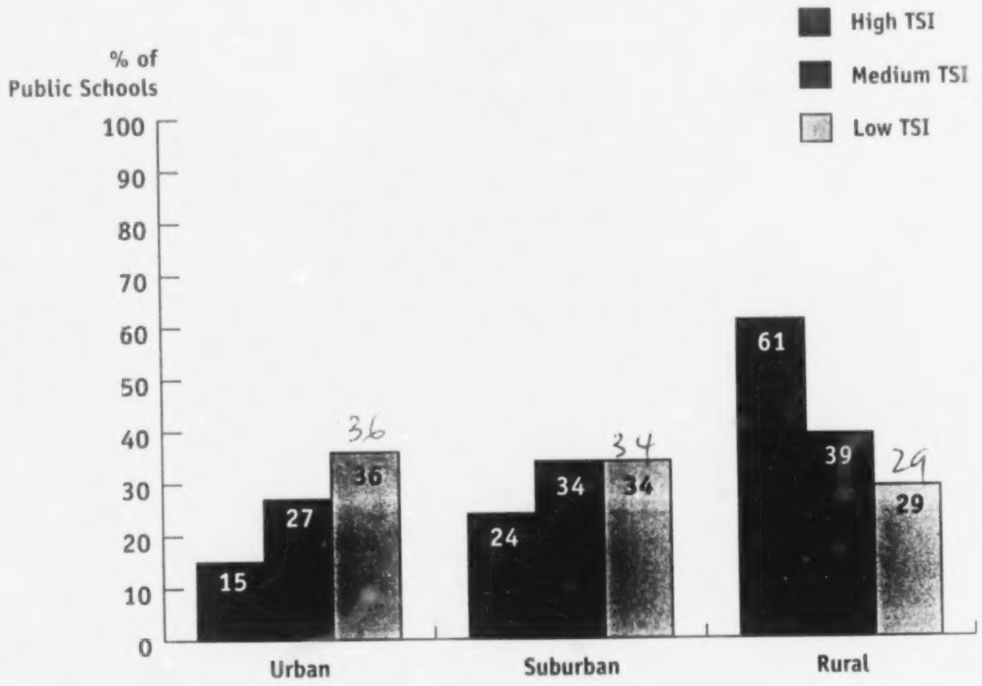
Source: Market Data Retrieval, 2000, Public School Findings.

Metro Class

The majority of High TSI schools, 61%, are rural schools, while only 15% are urban. High TSI schools are more than twice as likely to be rural than are Low TSI schools. Urban, suburban, and rural schools are more evenly distributed in the Medium and Low TSI categories. Over one-third of Low TSI schools are urban schools compared to 27% of Medium TSI schools and 15% of High TSI schools.

Figure 70

TSI by Metro Class



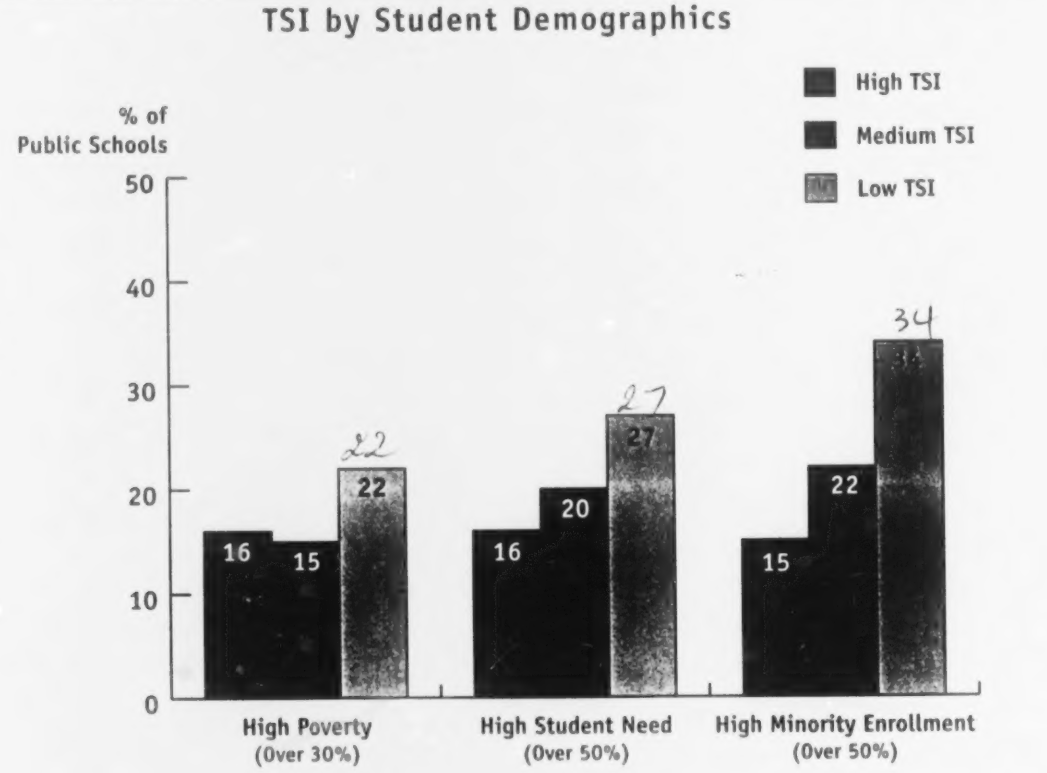
Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Poverty and Minority Demographics

Low TSI schools appear to be on the wrong side of the digital divide, as can be seen in Figure 71. Twenty-two percent of Low TSI schools are in districts with over 30% poverty-level enrollments, 27% have a high student need indicator (more than 50% of students qualifying for the free lunch program), and 34% have high minority enrollments (more than 50%). These Low TSI schools have significantly more students in need than their Medium or High TSI counterparts. The effect is particularly strong with respect to minority enrollments.

Figure 71



Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Low TSI schools are much more likely to be serving minority children than are Medium or High TSI schools. Thirty-six percent of High TSI schools have fewer than 5% minority students enrolled. Among Low TSI schools, 17% have less than 5% minority enrollments. Twenty-five percent of Medium TSI schools have fewer than 5% minority students.

Table 63

TSI by Minority Enrollment

	0%-4.9% (%)	5%-15% (%)	15.1%-50% (%)	51%+ (%)
High TSI	35.8	18.9	21.5	15.4
Medium TSI	24.9	21.5	27.4	21.6
Low TSI	16.8	17.3	26.4	34.2

Source: Market Data Retrieval, 2000, Public School Findings.

Poverty level indicates the percentage of children below the poverty line in the district. The higher a district's poverty level, the poorer the community it serves. While roughly 50% of both Medium and High TSI schools are in districts with fewer than 16% poverty-level enrollments, only 41% of Low TSI schools are in districts with fewer than 16% poverty-level enrollments.

Table 64

TSI by Poverty Level

	0%-15.9% (%)	16%-29.9% (%)	30%+ (%)
High TSI	47.7	35.0	15.5
Medium TSI	50.4	33.4	15.1
Low TSI	41.3	35.8	21.5

Source: Market Data Retrieval, 2000, Public School Findings.

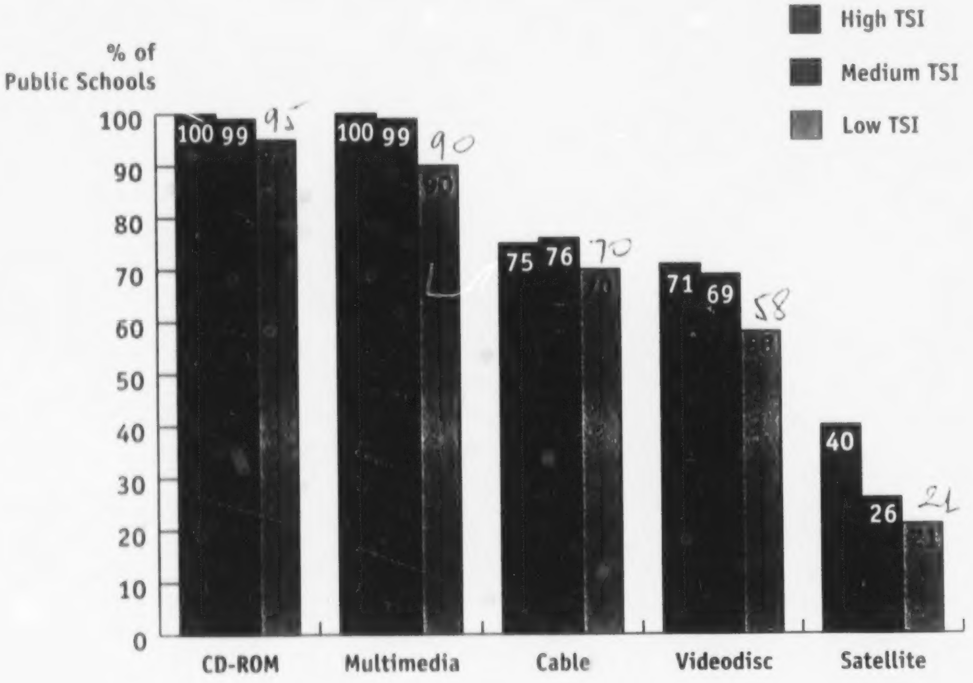
Technology Penetration

Low TSI schools consistently lag their Medium and High TSI counterparts with respect to technology penetration. TSI is a measure of not only the amount of technology in a school but also the level of student access to that technology. Therefore, a Medium TSI and a High TSI school could have the exact same number of classrooms with Internet access; however, the school with 1,200 students would carry a Medium TSI score and the school with 800 students would carry a High TSI score due to the level of access to the technology. The technology penetration percentages, however, seem to indicate that the Low TSI schools also have less technology in use.

For some categories, such as CD-ROM and multimedia, the penetration level differences are relatively minor. In other cases, such as videodisc and satellite, there are significant differences between the penetration levels within the TSI categories. This may reflect a lower level of overall investment in technology among Low TSI schools.

Figure 72

TSI by Technology Penetration



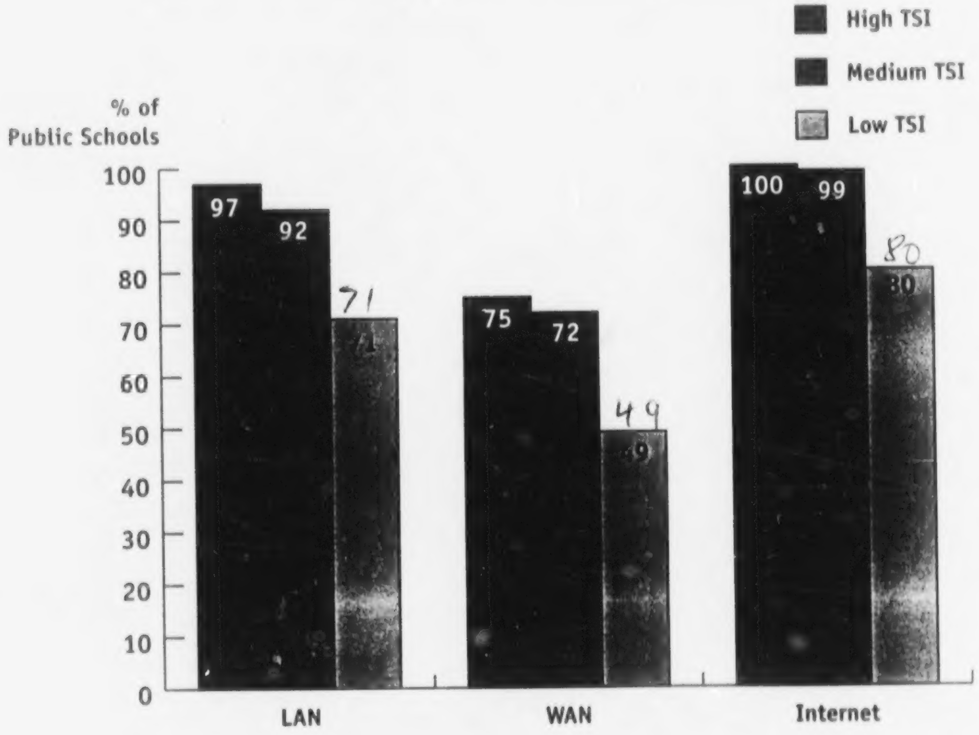
Source: Market Data Retrieval, 2000, Public School Findings

BEST COPY AVAILABLE

In terms of network technology access, there are virtually no differences between the penetration percentages for High and Medium TSI schools. However, significantly fewer Low TSI schools report having LANs (71%), WANs (49%), and Internet access (80%).

Figure 73

TSI by Technology Penetration (continued)



Source: Market Data Retrieval, 2000. Public School Findings.

BEST COPY AVAILABLE

Computers and CD-ROM

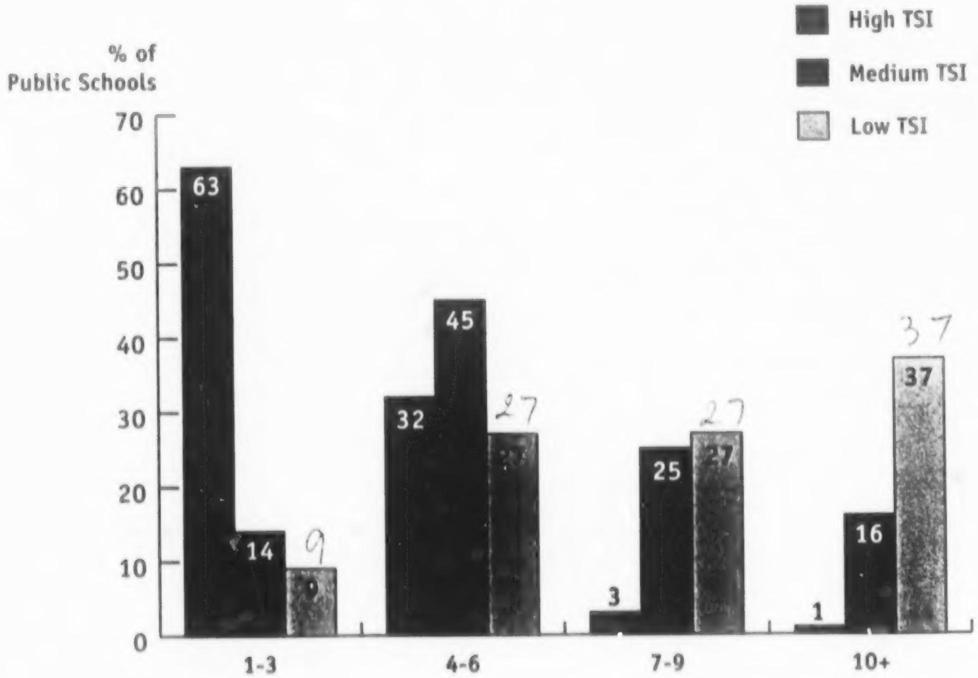
Computer Intensity

Since TSI is designed to measure the level of student access to technology, it is no surprise that the various TSI categories are strongly distinguished by their student-to-computer intensities. Virtually all (96%) High TSI schools provide student-to-computer intensities of 6 or fewer students per computer. Fifty-nine percent of Medium TSI schools and 36% of Low TSI schools provide this level of student-to-computer intensity.

The national computer intensity average for all schools is 4.9 students per computer. Sixty-three percent of High TSI schools provide student-to-computer intensities of 3 or fewer students per computer, much better than the national average. Only 14% and 9% of Medium and Low TSI schools, respectively, manage to achieve this very favorable computer intensity level. Only 1% of High TSI schools have computer intensity levels of 10 or more students per computer compared to 16% of Medium TSI schools and 37% of Low TSI schools.

Figure 74

TSI by Computer Intensity



Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Processor Type

When examining the installed base, processor type helps determine capability. The majority of High and Medium TSI schools are found at the higher end of the processor spectrum. Two-thirds of High TSI schools own computers based on 586 or better processors, as do 54% of Medium TSI schools. Among Macintosh owners, higher percentages of Medium and High TSI schools report owning Power Macs.

Significantly fewer Low TSI schools own 586 processors (36%) and 486s (34%). Fewer Low TSI schools (44%) own Power Macs as well.

Older computers, those equipped 386 processors or even older chips, are not able to run much of the software being designed and marketed today. More Low and Medium TSI schools report owning computers based on older processors. Students in these schools have less access to state-of-the-art equipment than do students at High TSI schools.

Table 65

TSI by Processor Type

	386 (%)	486 (%)	586 (%)	Power Mac (%)
High TSI	27.9	44.8	67.2	51.8
Medium TSI	35.2	42.6	53.6	56.6
Low TSI	35.3	33.9	35.5	44.2

Source: Market Data Retrieval, 2000, Public School Findings.

CD-ROM Intensity

Virtually all (96%) High TSI schools provide student-to-CD-ROM intensities (ratio of students-to-CD-ROM drives) of 9 or fewer students per CD-ROM drive. Forty-five percent of Medium TSI schools and 29% of Low TSI schools provide this level of student-to-CD-ROM intensity. (See Figure 75.) In 2000 the CD-ROM intensity (ratio of students-to-CD-ROM drives) for all schools is 7.3.

The Low TSI schools fare poorly on the CD-ROM intensity scale. While less than 1% of High TSI schools and 9% of Medium TSI schools have CD-ROM intensity levels of 25 or more students per CD-ROM drive, 36% of Low TSI schools are at this unfavorable level.

Table 66

TSI by CD-ROM Intensity

	1-9 (%)	10-14 (%)	15-19 (%)	20-24 (%)	25-34 (%)	35+ (%)
High TSI	95.6	3.1	0.7	0.3	0.2	0.2
Medium TSI	45.0	27.0	13.1	6.1	3.7	5.2
Low TSI	28.6	13.6	12.4	8.9	11.0	25.4

Source: Market Data Retrieval, 2000, Public School Findings.

Internet Access

Aided in part by the E-rate, Internet access has approached the point of being nearly universal. Internet penetration now stands at 94% of schools nationwide. Virtually all (99%) High and Medium TSI schools have Internet access, followed by 80% of Low TSI schools.

Internet Connection Type

Schools with Internet access were asked to indicate how they gained access to the Internet. Half or more of Medium and High TSI schools report using TI lines, while only 19% of Low TSI schools do so. Among Medium and Low TSI schools, nearly one in five schools (17% of Medium TSI schools and 19% of Low TSI schools) report using standard modems to access the Internet. The second most popular way to access the Internet among High TSI schools is 56Kb lines.

Today an increasing number of schools access the Internet via some form of dedicated network connection, as opposed to dial-up access. Dedicated connections have the advantage of being faster and having a higher bandwidth than dial-up connections. Over two-thirds of Medium and High TSI schools use some form of dedicated access—56Kb lines, T1 lines, or cable modems—to reach the Internet; less than one-third (30%) of Low TSI schools use some form of dedicated access.

Table 67

TSI by Internet Connection Type

	T1 (%)	Individual/Network Modem (%)	56Kb (%)	ISDN (%)	Cable Modem (%)
High TSI	57.6	8.7	13.8	6.8	5.6
Medium TSI	49.3	17.0	10.7	7.9	7.6
Low TSI	18.9	19.4	5.2	4.5	6.0

Source: Market Data Retrieval, 2000, Public School Findings

Locations of Internet Access

Schools in all the TSI categories provide Internet access in multiple locations. Medium and High TSI schools are pushing forward on extending Internet access to the classrooms in their buildings. Low TSI schools lag badly with respect to classroom access. Virtually all (97%) High TSI schools provide Internet access in classrooms, followed by 83% of Medium TSI schools. Only 40% of Low TSI schools report classroom Internet access. (See Table 68.)

Many schools in all categories also provide Internet access in the library/media center. While fewer Low TSI schools (55%) provide Internet access in libraries/media centers than do Medium TSI schools (82%) and High TSI schools (89%), the library/media center remains the likeliest Internet access location for Low TSI schools. It appears that given the resources available, Low TSI schools have decided that providing access in a centralized location like the library/media center is an effective way of making the Internet available to as many students as possible. Computers connected to the Internet in a library/media center can be used throughout the school day and after school as well, given that it is relatively easy to supervise this centralized location.

While 80% or more of Medium and High TSI schools provide Internet accees in administrative offices, only 45% of Low TSI schools do so.

Table 68

TSI by Internet Access Location

	Classroom (%)	Computer Lab (%)	Library (%)	Administrative Office (%)
High TSI	97.0	87.3	88.6	93.6
Medium TSI	82.8	68.9	82.1	80.8
Low TSI	39.6	38.7	55.0	45.0

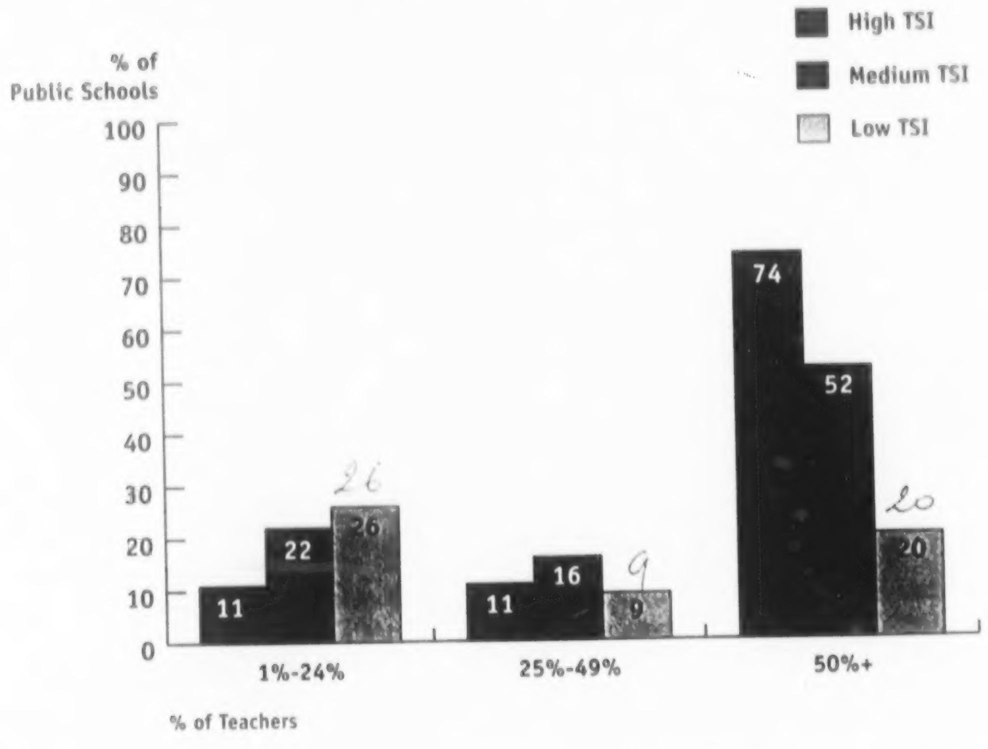
Source: Market Data Retrieval, 2000, Public School Findings.

Internet Use for Instructional Purposes

Schools with Internet access were asked to report the percentage of their teachers who use the Internet for instructional purposes. Seventy-four percent of High TSI schools indicate that the majority (50%+) of their teachers use the Internet for instructional purposes. Only 20% of Low TSI schools report this high level of teacher Internet use. Over half of Medium TSI schools (52%) report that the majority (50%+) of their teachers use the Internet for instructional purposes.

Figure 75

TSI by Teacher Use of the Internet for Instruction



Source: Market Data Retrieval, 2000, Public School Findings.

BEST COPY AVAILABLE

Methodology

Market Data Retrieval has maintained a database of information on the education market for over 30 years. Extensive ongoing research and data compilation maintain the high quality of the database. The 1999-00 public school technology survey is part of that ongoing effort. All of the information gathered from the survey has been matched to MDR's comprehensive district and school demographic data as well as its file of 3.4 million educators by name. This allows for an unsurpassed level of accuracy when profiling and segmenting the education market.

Sample and Data Gathering

From October 1999 to March 2000, all 87,700 public schools in the United States received the MDR 2000 Technology Survey by mail, phone, or the Internet. In total, approximately 30,200 schools completed the survey, yielding an overall response rate of 34%. Of those schools that responded, the majority (88%) responded to the phone survey. A combination of mail and Internet respondents account for the remainder. It should be noted that the survey questions relating to teachers' technology-use skill level, teachers using computers, average hours of technology training, teachers with school-based e-mail addresses, technology spending, and computer availability after school hours were asked of a randomly selected subset of 7,500 schools and received a median response rate of 64%. This level of coverage is more than adequate to produce statistically sound results.

Survey Respondents

When the technology survey was completed in March 2000, a total of 30,200 public schools (34%), enrolling approximately 15.4 million students, had responded. A representative sample of the total respondent universe, approximately 18,700 public schools, forms the basis of this report. The sample of respondent schools enrolls a total of approximately 9.4 million students or 20% of all public school students.

All data was gathered at the school building level. Computer installed base, brand share, and instructional computer intensity (student-to-computer ratio) data were developed using a projection model that allows MDR to estimate the total installed base in use in U.S. public schools. All other data is presented as a percentage of the actual number of respondents. If any other special conditions apply, they have been appropriately noted in that section of the report.

About Market Data Retrieval

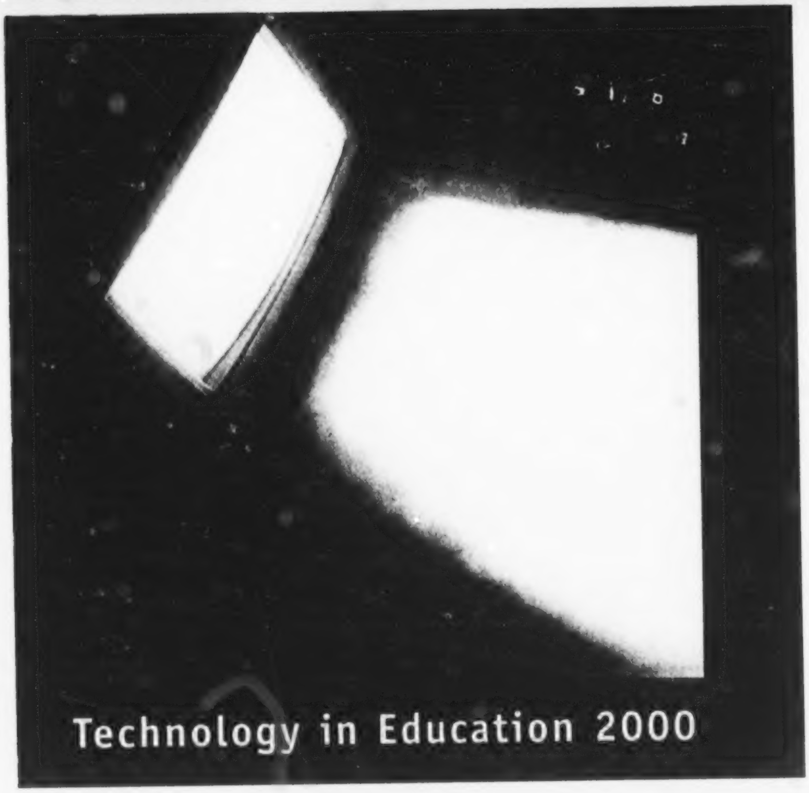
Market Data Retrieval (MDR) is headquartered in Shelton, Connecticut, with regional offices in Chicago, Illinois, and San Francisco, California. MDR is a leading provider of information on the education market. Its databases include over 4.7 million educators at more than 250,000 institutions—from preschool through college, including day care centers and public libraries. MDR's state-by-state school directories are published annually and are available in print and electronic formats. In addition to publishing the annual *Technology in Education* report, MDR also publishes a variety of research reports, including *New Teachers and Technology, E-Mail Marketing Outlook,* and *The College Technology Review.*

About the Author

Anne Wujcik, principal of Wujcik and Associates, has over 25 years of experience in the field of education. Anne, who holds a master's degree in early childhood education, began her career as a classroom teacher and later became a consultant. Subsequently she assumed product development responsibility at Follett, an educational publishing house.

In 1981 Wujcik joined TALMIS, the leading market research company focused on educational technology use, as Publications Manager and later served as Director of Research. After TALMIS was acquired by LINK Resources, Anne joined LINK as a Program Director. In 1988 Wujcik left LINK to begin her own consulting business. She continues to work for a wide variety of clients on projects that focus on the market potential for interactive technologies in education and industry and has served as a consultant to NIE, the U.S. Department of Education and the Office of Technology Assessment.

In 1993 Wujcik became an associate of Nelson B. Heller & Associates. She is managing editor of the *Heller Report on Educational Technology Markets,* the *Heller Report* Web site and its **Desktop EdNET** information service. Anne is also a much-sought-after speaker, having made presentations at conferences such as CES, SIIA, and NECC.



Technology in Education 2000

Market Data Retrieval
A company of The Dun & Bradstreet Corporation

Eastern Region
1 Forest Parkway
P.O. Box 907
Shelton, CT 06484-0947
Tel: 203-926-4800
Fax: 203-926-0784

Midwest Region
55 West Monroe Street
Suite 2500
Chicago, IL 60603-5003
Tel: 312-263-4169
Fax: 312-345-4360

Western Region
475 Sansome Street
Suite 1700
San Francisco, CA 94111-3103
Tel: 415-732-5100
Fax: 415-732-5151

800-333-8802 mdrinfo@dnb.com www.schooldata.com